Erosion Control
Technology Council

FACT SHEET:

TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP)

Stormwater Technology Fact Sheet

Temporary Rolled Erosion Control Products (RECPs)

Subcategory: *Erosion Control*

Description

This fact sheet describes the use of temporary Rolled Erosion Control Products (RECPs). In general, an RECP is a material, manufactured or fabricated into rolls, designed to reduce soil erosion and assist in the establishment, growth and protection (reinforcement) of vegetation. A temporary RECP is composed of biologically, photochemically or otherwise degradable components that yield proper performance for up to thirty-six months. For applications where natural vegetation alone will provide sufficient permanent erosion protection, a temporary RECP should be used. A variety of longevity and performance options are available to match project needs.

RECPs entered the market in the late 1960's as a more efficient alternative to conventional mulching techniques. RECPs are typically installed on hillslopes, road cuts, as channel liners, or on levees. The products are secured atop a prepared seedbed. As erosive forces like rainfall, rain splash, flowing water or wind are applied, the soil and seedbed are protected underneath the RECP. Over time, the seed germinates, and vegetation establishes through the material, becoming integral and systemic. As the material degrades, plants are nurtured to maturity, leaving only the natural condition. Using RECPs has been shown conclusively to reduce erosion and yield a more robust stand of vegetation in less time. By minimizing erosion, increasing biomass and leaving no footprint, RECPs provide significant benefits:

- Reduced flow velocity and energy
- Increased filtration opportunities
- Reduced polluted runoff
- Reduced sediment load to waterways
- Increased safety at roadways
- Lower life-cycle project costs
- Increased safety for structures and roadways

Erosion Control Blanket Components

RECPs are comprised of four basic types of products: mulch-control nets, open-weave textiles, erosion-control blankets and turf reinforcement mats. The component materials, longevity, and performance delineate the categories. Mulch-control nets are used in conjunction with loose mulch placed on a site. Open-weave textiles are planar fabrics with a significant open area and are typically woven jute (coir) products. Erosion control blankets usually consist of processed natural or polymer fibers mechanically (netting and stitching), structurally or chemically bound together to form a continuous matrix of significant thickness and coverage. Manufactured from wood fibers, straw, jute, coir, polyolefins, PVC and nylon, this growing family of materials enables designers to incorporate long-fiber mulches with the tensile strength of dimensionally stable nets, meshes, and geotextiles. Netting can be applied only to the top of the product or both sides. The variety of component materials allows for a broad spectrum of efficient and economical solutions for all types of projects.

The type(s) of fibers and netting used in RECPs governs the functional longevity and performance of the product. Longevity refers to how long the product will provide erosion protection before decomposing by UV (sunlight) and/or biological activity. Regarding performance, a designer may consider a product for many reasons: the ability to reduce erosion, increase vegetation establishment, encourage or discourage infiltration, ability to be dyed, weed free status, wildlife friendly, degrade in the absence of sunlight, and cost. In any case, the unique combination of components facilitates the desired result. Table 1 provides a summary of the most common netting types and Table 2 provides an overview of the most common matrix fiber types.

Netting Type	Description	Design Considerations
Synthetic	Extruded net fabricated from synthetic materials (typically, but not exclusively polypropylene) of various configurations of weight and strand count (opening size).	Strong and durable enough to meet industry performance requirements. Less expensive than bio-based or natural fiber alternatives.
Photodegradable Synthetic	Extruded net fabricated from synthetic materials (typically, but not exclusively polypropylene) of various configurations of weight and strand count (opening size). Photodegradable (requires sunlight) additives included to reduce the time to breakdown.	Degrades with exposure to sunlight. Strong and durable enough to meet industry performance requirements. Less expensive than bio-based or natural fiber alternatives.

Table 1. Summary of Netting Types (continued on the next page)

Netting Type	Description	Design Considerations
Oxo-biodegradable Synthetic	Extruded net fabricated from synthetic materials (typically, but not exclusively polypropylene) of various configurations of weight and strand count (opening size). Oxo-biodegradable (requires sunlight, heat and oxygen) additives included to reduce the time to breakdown.	Degrades with brief exposure to UV then heat and oxygen complete the degradation process. Strong and durable enough to provide meet industry performance requirements. Less expensive than bio-based or natural fiber alternatives.
Stabilized Photodegradable Synthetic	Extruded net fabricated from synthetic materials (typically, but not exclusively polypropylene) of various configurations of weight and strand count (opening size). Photodegradable (requires sunlight) additives included to balance the time to breakdown.	Degrades with exposure to sunlight. Strong and durable enough to meet industry performance requirements. Balanced material formulation to ensure performance along with degradation over time. Less expensive than bio-based or natural fiber alternatives.
Stabilized Oxo-biodegradable Synthetic	Extruded net fabricated from synthetic materials (typically, but not exclusively polypropylene) of various configurations of weight and strand count (opening size). Oxo-biodegradable (requires sunlight, heat and oxygen) additives included to balance the time to breakdown.	Degrades with brief exposure to UV then heat and oxygen complete the degradation process. Strong and durable enough to provide meet industry performance requirements. Balance material formulation to ensure performance along with degradation over time. Less expensive than bio-based or natural fiber alternatives.
Extruded Bio-based Netting	Extruded net fabricated from bio-based compounds (i.e. corn PLA). Typically larger opening size, with varied weight and opening configurations.	Reduces use of petroleum based products. More expensive.
Natural Fiber Biodegradable Net	Woven net consisting of natural fibers oriented to be mostly open, compared to open weave textiles that have less open area. Weight and strand count (opening size) varies. Weave pattern varies with some advantageous configurations.	Consists only of natural components, biodegradable, With Leno weave, reduced entanglement of wildlife. More expensive.

Table 1. Summary of Netting Types

Netting and fiber types may be mixed and matched to yield advantageous or preferred configurations. An erosion control blanket can have different types of nets for the top and bottom of a product and fiber types may be blended in varying proportions. These configurations represent a significant share of the standard rolled erosion control products. However, other products are made by various techniques that do not utilize netting or incorporate the matrix with netting in a unique manner. All these products are included in standardized classification, if not in the group of typical component types above.

Fiber Type	Description	Design Considerations
Straw	Long straw fiber typically collected from wheat, rye or rice harvest. Fiber varies in dimension and precise composition.	Biodegradable, fastest degrading of typical fibers. Despite inspection or certification, may contain seed from original crop or other weed. Creates dense matrix of coverage, yielding good soil protection. Ensure correct number of staples are used to avoid tenting. Can be used with any netting. Least expensive of typical fibers.
Wood (Excelsior)	Machine produced, engineered fiber produced by shaving specified dimensionally controlled logs. Typically produced from aspen.	Biodegradable. No foreign seed component. Creates open matrix of coverage, yielding good soil protection and less potential for tenting as vegetation establishes. Fiber has the potential to be dyed, for aesthetics and can be used with any netting. More expensive than straw fiber, less expensive than coconut fiber.
Coconut	Fiber harvested from the coconut husk. Typically four to six inches in length.	Biodegradable and photodegradable. Longest lasting common, natural fiber. Not native to the United States, must be imported, thus, requires import inspection to ensure no weeds and undesirable insects are present. Forms dense matrix of coverage, yielding good soil protection, Ensure correct number of staples are used to avoid tenting. Can be used with any netting. Most expensive of common, organic fiber types.
Synthetic	Machine produced, engineered fiber comprised of synthetic materials, typically, but not exclusively, polypropylene.	Photodegradable fiber that is long lasting (years). May be produced of virgin or recycled source product. Not used in temporary products. May be UV stabilized. Most expensive fiber type.

Table 2. Common Fiber Types

Classification

The Erosion Control Technology Council (ECTC) classifies RECPs by functional longevity as either:

Type	Description	Longevity
1	Ultra Short Term	up to 3 months
2	Short Term	up to 12 months
3	Extended Term	up to 24 months
4	Long term	up to 36 months
5	Permanent	> 36 months

This fact sheet focuses on types 1, 2, 3 and 4.

RECPs are applicable on sites requiring greater, more durable and/or longer lasting erosion protection. Applications include:

- Gradual to steep slopes,
- Low to high flow channels
- Low-moderate impact shore linings

Temporary degradable RECPs are designed to degrade as vegetation becomes established, so they are limited to areas where natural, unreinforced vegetation alone will provide effective long-term soil stabilization. Severe slopes or channel lining applications where design flow-induced shear stresses will exceed the limits of natural vegetation may require a permanent TRM or some other form of long-term protection.

To further categorize RECPs, ECTC has developed the following standardized terminology for these products:

Mulch Control Netting (MCN)

"A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable RECP to anchor loose fiber mulches."

This class consists of two-dimensional, woven natural fibers or geosynthetic biaxially-oriented process nets used for anchoring loose fiber mulches such as straw or hay. Mulch-Control Nettings (MCNs) are rolled out over the seeded and mulched area and stapled or staked in place. Because they are not glued or stitched to mulch, these nets do not provide the same degree of structural integrity offered by pre-fabricated erosion control blankets. ECTC recommends MCNs for use in moderate site conditions with slope gradients up to 5:1 (H:V) and drainage swales with flow-induced shear stress not exceeding 0.25 lbs/sf. unvegetated.

Open-Weave Textile (OWT)

"A temporary degradable RECP composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment."

OWTs are woven or processed from synthetic or natural fiber yarns such as jute or coir. The woven construction of these materials enables them to provide erosion control with or without the use of an underlying loose mulch layer.

Ultra-Short Term and Short Term OWTs

Short term OWTs, are limited to slope gradients of 3:1 (H:V) or less and channel applications with shear stresses not exceeding 1.5 lbs/sf unvegetated.

Extended Term and Long Term OWTs

Extended term and long term OWTs are often employed where higher strength is required, such as on steepened slopes or as a reinforcing underlay for sod. OWTs are also commonly used in bioengineering applications to protect and reinforce lifts of soil, particularly when woody plants are the natural stabilizing material. Extended term OWTs, which last up to 24 months, are suitable for slopes up to 1.5:1 (H:V) and channels with shear stresses of 2.0 lbs/sf unvegetated or less. Long term OWTs, lasting up to 36 months, are used on slopes up to 1:1 (H:V) and in channel applications where shear stresses are 5.5 lbs/sf unvegetated or less.

Erosion Control Blanket (ECB)

"A temporary degradable RECP composed of processed natural and/or polymer fibers mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment."

Manufacturers make ECBs of various degradable organic and synthetic fibers that are woven, glued or structurally bound with nets or meshes or into a fused netless matrix. The most widely used erosion control blankets are made from straw, wood, coconut, polypropylene or a combination thereof stitched or glued to geosynthetic nettings or woven natural fiber nettings.

This classification spans a very broad application range since variety in the fiber, and netting components can provide different degrees of blanket effectiveness, durability, and functional longevity. These materials are rolled out on well-prepared soils to assure intimate contact and anchored with staples, stakes and / or anchor trenches.

Ultra-Short Term and Short Term ECBs

According to ECTC's RECP specification, Ultra Short Term, and Short Term ECBs are further categorized by the number of nets they possess. Netless ECBs, have a three month or 12-month functional longevity, respectively and are recommended for slope gradients up to 4:1 (H:V), and channels with shear stresses not exceeding 0.5 lbs/sf unvegetated. Single net Ultra Short Term and Short Term ECBs, three months or 12-month functional longevity, respectively, are recommended for steeper slope gradients up to 3:1 and channel lining applications with substantially higher maximum shear stresses of 1.5 lbs/sf unvegetated. Double net Ultra Short Term and Short Term ECBs, three months / 12-month category, may be used effectively on slopes up to 2:1 and in channels with shear stresses of 1.75 lbs/sf unvegetated.

Extended Term and Long Term ECBs

Extended Term and Long Term ECBs offer more effective and longer lasting erosion protection in areas where vegetation establishment may take 2 to 3 years. These products often consist of wood excelsior, coconut fiber, a combination of straw and coconut fiber, or some other long-lasting natural fibers, mechanically bound between two slow degrading natural or synthetic nets. Extended Term ECBs are recommended for slope gradients up to 1.5:1 (H:V) and channels with shears up to 2.0 lbs/sf unvegetated. Long Term ECBs are suitable for slope gradients up to 1:1 (H:V) and in channels where maximum shear stresses reach 2.5 lbs/sf unvegetated.

Applicability

Ultra-short Term Products

An RECP designed to last three months or less. They are used in areas where vegetation can be quickly established and will be mowed soon after installation. The netting and bonding materials (e.g. stitching thread) on ultra-short-term products degrade quickly to prevent entanglement with mowing equipment.

Short-term Products

An RECP designed to provide erosion protection for longer than three months and up to 12 months. This is basically one growing season for the establishment of vegetation.

Extended-term Products

An RECP designed to provide erosion protection for longer than 12 months and up to 24 months. These products are used in areas where vegetation establishment may take up to two full growing seasons. These products are often used in semi-arid locations.

Long-term Products

An RECP designed to provide erosion protection for longer than 24 months and up to 36 months. These products are often used in semi-arid locations or where vegetation establishment may take multiple growing seasons to reach optimum density.

Advantages & Limitations

One advantage RECPs offer is the level of confidence in the quality, consistency, and performance. Manufactured products are held to the highest standard of evaluation and regulation. Further, manufactured products are designed and produced from various materials to meet the varying requirements and challenges found in the field. In particular, RECPs are available in a variety of compositions and roll sizes to provide maximum erosion protection, increased infiltration, and/or enhanced mulching capability. Further, RECPs are designed to have expected longevities ranging from forty-five days to over three years. Thus, RECPs can provide an erosion control professional an acceptable solution to nearly every design challenge. Typically an RECP matrix comprised of agricultural straw fibers lasts up to 12 months, an RECP matrix consisting of coconut fibers lasts up to 36 months, and an RECP matrix comprised of aspen excelsior lasts from 15 to 36 months depending on the amount of fiber contained in the particular product.

RECPs are physically bonded together and they mechanically anchored to the soil using fasteners and are designed to be used in areas with moderately concentrated flows and channelized areas. Typical fasteners are steel wire turf staples, biodegradable turf staples, and wooden pegs. Following the Manufacturer's recommended staple patterns is important. Proper anchoring patterns prevent “tenting” or the process of the RECP being pushed up by vegetation. Correct staple patterns hold the RECP down as the plants readily grow up through it.

Rolled erosion control products cannot be installed in some situations due to the topography and or a difficult to reach location. On a very steep or vertical slope RECPs may not be able to be installed safely. In those situations, a hydraulically applied erosion control product or other erosion control measure may be necessary. https://www.ectc.org/toolbox. RECPs are not designed for sustained use in submerged applications

Design Considerations

When selecting rolled erosion control products (RECPs), the following design parameters should be considered. Jobsite conditions such as weather, soil type, design hydraulics, slope gradient, etc. need to be considered before selecting a solution. The performance rating of the RECP indicates product effectiveness in the chosen application. Product longevity and the nature of degradation should also be considered. For example, in areas where vegetation may be slow to establish longer term products should be selected. Or in the case of a bio-sensitive project site, RECPs should be chosen with biodegradable components.

If an area will have little ability to establish vegetation, or the calculated erosion stresses exceed the limits of vegetation alone, temporary RECPs should not be selected and permanent solutions may be needed.

Performance

Testing and research that the RECP industry utilize has proven to be a major catalyst in the overall increase in confidence and use of the technology. Detailed testing has been conducted on hundreds of products under various conditions and protocols. Testing for slope installations has focused on the ability of the RECP to mitigate the forces of rainfall and runoff while maintaining soil in place. Several facilities throughout the country are configured and utilized for testing. ASTM International maintains a refereed standard (D6459) for the large-scale evaluation of RECPs performance on a slope. The ASTM standard requires the product to be tested on a 3:1 (H:V) slope and be subjected to a series of controlled rainfall events while monitoring sediment migration and runoff.

ASTM International maintains a standard (D6460) for the large-scale evaluation of RECPs performance in a channel.

The ASTM standards provides a methodology for testing and a means of comparison to evaluate competing products and technologies. In addition to the ASTM standards, implementation of approved product programs on the state and federal level typically requires testing by alternate protocols.

Effectiveness

Using the ASTM D6459 protocol results in a cover factor (C-factor) value for the RECP tested. The C-factor offers a designer the percent effectiveness of the RECP in preventing soil loss from the rainfall impacting the slope. The C-factor is inversely proportional to percent effectiveness, in which the smaller the C-factor, the greater the effectiveness. Specifiers often incorporate minimum C-factors into a project RECP specification based on onsite erosion potential. It is not uncommon to see erosion control blankets reducing erosion by more than 98% in full-scale testing.

In channel based applications, the permissible shear stress value obtained from ASTM D6460 should be used to determine the effectiveness of an RECP in a channelized application. A safety factor (calculated by dividing permissible shear stress of product into calculated shear stress) is often determined to understand an RECPs effectiveness in a channel flow. It is not uncommon to see temporary erosion control blankets with unvegetated test values up to 3.5 pounds per square foot in standardized testing. Typically a safety factor between one and two is used as a minimum for determining a product's stability and overall effectiveness.

Cost Considerations

With a broad range of erosion blankets on the market utilizing a variety of component types, costs can vary from product to product and manufacturer to manufacturer. Generally speaking as the RECPs increase in longevity and performance the price also increases.

When considering the costs associated with uncontrolled erosion including site rework, soil loss, and a potential for environmental fines, the employment of temporary RECPs to protect lands and aid in vegetation establishment can save the project in the long run.

References

"ECTC Classification of Erosion Control Materials Commonly Used as EPA BMPs," Erosion Control Technology Council, 2013.

Erosion Control Technology Council (2014) Terminology section retrieved from http://www.ectc.org/terminology.