Erosion Control

Product Acceptability Lists
for
Multi – Modal Applications

PAL

July 2012 Edition

EROSION CONTROL PRODUCT ACCEPTABILITY LISTS (PAL)

Prepared by:

The WisDOT ECSW Committee

Peter J Kemp, Chair

WisDOT - BTS

Prepared for:

The WisDOT Engineering & Project Development Staff and Consultants.

Updated July 2012

Wisconsin Department of Transportation

TABLE OF CONTENTS

EROSION CONTROL

PRODUCT ACCEPTABILITY LISTS (PAL)

Introduction:

This is a list maintained for the Wisconsin Department of Transportation projects. It may not be a complete list of all applicable practices for private and commercial projects administered or permitted through either the Department of Commerce or the Department of Natural Resources. Please contact those agencies directly for alternate approval methods.

The department reserves the right to conduct field trials or limited use of products on projects even if all requirements for approval are satisfied. This will be at the discretion of the Erosion Control Storm Water, Product Acceptability Sub-Committee.

The Wisconsin Department of Transportation (WisDOT), compiles the Erosion Control Product Acceptability Lists (PAL) for Erosion Mats, Soil Stabilizers, Tackifiers, inlet protection, and temporary ditch checks. All products in these lists shall meet the Department's Standard Specifications for Road and Bridge Construction. **Products included in these lists shall be manufactured with the same quality and composition as the test material originally submitted for evaluation.**

The lists below are organized into four major erosion control product categories. A section intended to clarify the criteria in the PAL and outline the general requirements for product acceptability supplements each category. The lists are updated as needed and posted online for WisDOT engineering staff, erosion control manufacturers, distributors, contractors, consulting engineers and other interested parties. Any person interested in the status of a product or in obtaining a copy of the latest PAL may do so online at http://www.dot.wisconsin.gov/business/engrserv/pal.htm .

All requested changes or additions to the PAL should follow the instructions at the web page address given above or be forwarded to the Bureau of Technical Services or in writing to:

New Product Engineer
WisDOT
3502 Kinsman Blvd
Truax Center
Madison, WI 53704

All installation instructions submitted by the manufacturer, or the distributor, to WisDOT shall contain reliable methods of installation for all of the following project locations applicable: slopes, channels, shorelines, high wind locations, and areas next to live traffic lanes. The manufacturer or distributor, as appropriate, shall include a copy of these instructions with the submittal

Pal Submittal Procedure

To be included on WisDOT PAL, manufacturers will need to send complete product information to Wisconsin Department of Transportation by September 2nd and April 2nd of each period for review. Late applications will default to the next review period. If an altered or a new product is to be considered for placement on the PAL, the

Erosion Control and Storm Water (ECSW) Work Group must approve it. The approval process involves reviewing the product data submitted by the manufacturer or distributor. **The PAL will be posted in its entirety as needed.**

WisDOT requires the following product information for product approval:

1. Product sample size of approximately a 10 ft^2 (1.0 $m^{2)}$ sample will be required for mat and geotextile products (rolled products shall be sent rolled); representative samples shall be included for all other products.

2. Product Specifications, Product literature, Installation references, Field performance data, Lab test data (Certified lab results from a qualified laboratory capable of performing the required tests typically independent from Manufacturer's tests), any other state agency that has testing in progress, tests completed and/or product approval.

3. A completed Product Preliminary Information Sheet (PIS) provided by WisDOT -Technology Advancement Unit, (See form sample in Appendix A).

4. Private label identification: Provide a letter from the private labeler identifying his source and name of material along with a companion letter from the manufacturer. Material properties and identifying names shall be included in the letters of certification.

Products passing lab tests are not guaranteed a place on WisDOT PAL. WisDOT standards must be met. WisDOT retains the right to make any changes, additions or deletions to the PAL as needed and also seek concurrence from the Wisconsin Department of Natural Resources on products' environmental compatibility. Products not environmentally compatible will be disallowed. For products to be approved and placed in their appropriate categories, certified lab results, as well as a statement of compliance with WisDOT standards are required. Wisconsin DOT reserves the right to remove a product from the list when laboratory or field performance proves to be unsatisfactory. The most recent PAL at the time the project letting for any project remains valid for that project, however new products added to the PAL after the letting may be allowed on the project.

Product information submitted by the manufacturers to WisDOT will not be considered confidential unless otherwise noted.

Tackifiers must meet the minimum requirements of Michigan DOT and listed on their approved lists. In addition, Wisconsin DOT does not approve asphalt based tackifiers or products deemed environmentally incompatible.

Temporary ditch checks index values will be reviewed for comparison to products already approved. Products found to have similar material properties and product performance will be considered for approval. Non-traditional materials may require a field demonstration in addition to a literature review.

EROSION MATS

WisDOT defines "erosion mat" as a manufactured blanket or mat that is delivered to the work site in rolls or strips, with a minimum thickness of 1/4 inch (6 mm). Erosion Control Mats are organized into three Classes of mats, which are further broken down into various Types. Each Type of mat must be capable of sustaining the required Minimum Product Permissible Shear Stress for the duration specified in the Class to which it is assigned.

The requirements listed below must be met for an erosion mat product to be considered in the WisDOT PAL. See also the WisDOT Facilities Development Manual, Procedure 10-10-15 for more information.

Private label identification: A letter of certification shall be provided from the private labeler identifying his source and name of material along with a companion certification letter from the manufacturer. The certification shall address the source, material properties and identifying names in the letters of certification.

GENERAL SPECIFICATIONS

1. Channel and Slope Erosion Protection: ASTM D6459-07 and ASTM D6460-07 test results from the American Association of State and Highway Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP) , will be submitted for approval of all erosion mats. Products with quick degrading netting due to ultraviolet exposure may be approved based on mats of identical design form a company's product line with ultraviolet stabilized netting.

Reports to WisDOT shall include but not limited to:

1. Procedure
2. Site conditions
3. Geotechnical information
4. Material type, installation, and index values on tested material following the NTPEP procedures. This does not include bench scale soil loss testing.
5. Calibration
6. Test set up
7. Test procedure and data collection.
8. Analysis and data interpretation including the revised universal soil loss index number, shear stresses for channels, channel velocity, energy slope and Manning's resistance coefficient at all flows.
9. Summary of test results
10. All raw data and calculations

2. Minimum Product Permisible Shear Stress: All approved erosion mats must meet the minimum product permissible shear stress requirements for the category that they have been assigned to while maintaining a level of soil protection in a bare soil condition. Failure in shear is defined by the loss of 0.50 inch of soil in the channel. The 0.50 inch of soil loss is defined for this test as the average sums of the soil degradation not to include areas of soil aggregation.

Modifications to ASTM D6460 are as follows:

1. 7.1.2 - Test in one soil type. Soil to be a loam as defined by standard.

2. 3 channel runs with erosion mat for each channel to be from a different lot of material.

3. Slope Erosion Protection: All approved erosion mats must meet the minimum product Cover Management (C) Factor from the Revised Universal Soil Loss Equation (RUSLE) of the USDA-ARS Agricultural handbook 703 for the category that they have been assigned to while maintaining a level of erosion protection in a bare soil condition. The reports shall report the C factor at an R of 231 from a plot of rainfall-runoff erosivity factor (R) vs. C. In addition the corresponding best fit regression equation and R squared number generated from plots using best fit regression. Regressions using linear, power and exponential shall be evaluated and referenced and their corresponding C factor and R squared number with the best fit line forced through zero.

Modifications to ASTM D6459-07 are as follows:

1. 7.1.2 - Test in one soil type. Soil to be a loam as defined by standard.

2. Material tested shall be to be from a different lot of material for each of 3 test plot.

3. Total kinetic energy calculation in 8.1.4 shall not be required.

4. **Vegetative Enhancement:** results for vegetative enhancement will be submitted from a recognized testing facility. All erosion mats in the PAL must allow vegetation to achieve the following minimum vegetative density when compared to mulched soil;

   A) 70% for sandy soils
   B) 80% for clay soils

5. **Recertification:** Recertification of products on a 3 year cycle will be required for products to remain on the approved list. Recertification will require the products to be tested through the AASHTO NTPEP Erosion Control Products Panel. Products will adhere to the NTPEP cycle regardless of date of application.

   Please contact Evan Rothblatt , AASHTO NTPEP Representative at (202) 624-3648 for more information on the NTPEP testing program or visit www.ntpep.org .

6. **Airport Restrictions:** The following apply to **ALL** airport projects:

A. Only Class I, Urban erosion mats that are double netted shall be allowed within 10 feet (3.05 m) of any airport pavement used by aircraft with the exception of airports classified as air carrier or corporate/transport. If the airport is classified as an air carrier or corporate/transport, there will be no erosion mats allowed within 30 feet (9.14 m) of pavement used by aircraft.

B. Only biodegradable anchoring devices shall be allowed in the installation of any erosion mat for airport applications. Biodegradable anchoring devices shall meet the requirements specified for Class I, Type Urban erosion mat anchoring devices. No metal staples will be allowed.

7. **Random Sampling of Products:** Once a product is on the PAL, random sampling may be conducted by WisDOT for comparison with the samples originally submitted to the State for approval. Comparative testing will be done against the representative sample. **Inconsistencies between product samples may result in the product's removal from the PAL until recertification is provided and compliance is established by the Erosion Control Storm Water Committee (ECSW).**

8. **Modification To An Approved Product:** The product quality or composition must not be changed in any way after the erosion mat product has been placed on the PAL unless WisDOT has approved these changes via the PAL Submittal Procedure on page iv of this document. Changes made without proper notice and adherence to standard procedures will result in the removal of the product from the PAL.

9. **Installation Instructions and Procedures:** All installations will conform to section 628 of the Wisconsin Department of Transportation Standard Specifications for Highway and Bridge Construction. **Installation procedures must insure that the mat will remain in contact with the soil.** Both the product and installation method, together, will determine performance. The failure of a product to perform acceptably will result in removal from the PAL list.

10. **Netted Photodegradable Products:** Erosion mats **Class 1, TYPE A** that are netted photodegradable products shall not be approved for use after September 1st. These products have a design life expectancy of 6 to 8 weeks. After this time has passed the products exhibit loss in strength and structural integrity. Proper time must be allowed for these products to establish vegetation prior to winter months. It has been shown that products installed after the September 1st deadline will not perform through the winter months and the following spring to allow vegetation to be established. These products do not degrade rapidly enough to be included in the Class I Type Urban Category.

CLASS AND TYPE SPECIFICATIONS

CLASS I

A short term duration (6 months or greater), light duty, organic, "Erosion Control Revegetative Mat" (ECRM). Non-organic, photodegradable or biodegradable netting allowed.

For those Class I mats that have netting attached, the netting and stitching shall be photodegradable and/or biodegradable as specified for that Class and Type of mat. The photodegradeable stitching shall be of the same material with similar properties as the netting such that the expected degradation periods are the same. The weight of the netting shall not exceed 15% of the total blanket weight.

The netting shall be bonded sufficiently to the parent material to prevent separation of the net from the parent material for the life of the product. This is particularly important as the vegetation starts to grow. If not sufficiently bonded the net has a tendency to float, which causes damage to maintenance equipment when slopes are mowed and increases the risk of animals being caught in the netting.

TYPE A

Minimum Product Permissible Shear Stress: 1.0 lbs/ft²(50Pa):

A netted product for use on slopes 2.5:1 and flatter with a C factor from the Revised Universal Soil Loss Equation of 0.10or less. **Not to be used in channels.**

Type B may be used in replacement for Type A mats at the contractor's option with no additional cost to the department**.**

TYPE B

Minimum Product Permissible Shear Stress: 1.50 lbs/ft²(70Pa):

A double netted product for use on slopes 2:1 or flatter with a C factor from the Revised Universal Soil Loss Equation of 0.10 or less, or, in channels here the calculated (design) shear stress is 1.5 lbs/ft² (70 Pa) or less.

URBAN - Not to be used in channels

A short term duration (6 months or greater), light duty, organic, "Erosion Control Revegetative Mat" (ECRM) meant for use in urban areas, or lawns, where mowing may be accomplished within two weeks with little or no snagging of the netting or mat.

All Type Urban mats shall conform to the requirements for Erosion Mats, with the following modifications:

1. Urban mats netting must be 100% organic biodegradable. This shall include parent material, stitching, and netting.
2. Class I Type B Urban mats may be single, double or no netted products.
3. The minimum mat thickness shall be 3/8 inch (9 mm) as measured in place.
4. All products approved in Urban Type A category will be allowed on slopes up to 4:1.

5. Slopes that are between 4:1 and 2.5:1 are required to use mats in the Urban Type B category.

6. The netting shall be stitched to prevent separation of the net from the parent material.

7.The netting shall be capable of withstanding moderate foot traffic without tearing or puncturing, and shall be in accordance with section 628 of the WisDOT Standard Specifications.

8.Neither the netting, nor the installation, shall pose a safety risk to pedestrians walking on, or crossing it

URBAN TYPE A

(No Minimum Product Permissible Shear Stress Required for netted products) A product for use on slopes 4:1 and flatter with a C factor from the Revised Universal Soil Loss Equation of 0.20 or less. Non netted materials must have a minimum permissible shear stress of 1.0 lb/sf.

Urban Type B may be used in replacement for Urban Type A mats at the contractor's option with no additional cost to the department**.**

Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting.

URBAN TYPE B

(Minimum Product Permissible Shear Stress: 1.0 LBS/sq. ft.); product for use on 2.5:1 slopes and flatter with a C factor from the Revised Universal Soil Loss Equation of 0.10 or less. **Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting.**

Anchoring Devices (URBAN)

1. All materials and additive components that are used to manufacture the anchoring devices shall be completely biodegradable as determined by ASTM D 5338-92.

2. All materials shall be environmentally safe, and shall have no potential for soil and/or water contamination.

3. Steel wire pins or staples will not be approved.

4. Petroleum based plastics or composites containing petroleum based plastics will not be allowed.

5. Materials deemed to present a hazard from splintering or spearing will not be approved. This shall include solid wood devices. However, devices manufactured from wood byproducts may be approved.

6. The anchoring devices shall maintain their mechanical anchoring ability for at least 2 (two) months, and substantially degrade within 4 (four) months during the months of warm soil conditions (above 53 degrees Fahrenheit).

7. The anchoring devices shall be shaped, using barbs, twists, bends, or other methods, to provide additional mechanical pull resistance when installed in the soil.

APPROVED CLASS I EROSION MATS

Class I Type A

PRODUCTS	MANUFACTURER
*Curlex I WH	American Excelsior
Curlex I	American Excelsior
Curlex I CL	American Excelsior
AEC Premier Straw SN	American Excelsior
ECS-1	East Coast Erosion Blankets
*ECS-1D	East Coast Erosion Blankets
ECX-1	East Coast Erosion Blankets
ECM S1000	Enviroscape
*ECM S1000D	Enviroscape
S31	Erosion Control Blanket.com
*S31UVD	Erosion Control Blanket.com
SS (formerly Proguard, S1 or Standard)	Erosion Control Systems
S75	North American Green
* DS75	North American Green
* DS150	North American Green
SC150	North American Green
Landlok S1	Propex
*Landlok S1RD	Propex
SNS	SoilTex
V 75 S	Verdyol
*V 75 S FD	Verdyol
Excel SR-1	Western Excelsior
Excel SR-1 Rapid Go	Western Excelsior
WintersStraw *SNW	Winters Excelsior
Winters Straw SNG	Winters Excelsior

Class I, Urban, Type A

PRODUCTS	MANUFACTURER
Curlex I Fibrenet	American Excelsior
Curlex II Fibrenet	American Excelsior
AEC Premier Straw Fibrenet	American Excelsior
S 75 BN	North American Green
S 150 BN	North American Green
SC 150 BN	North American Green
C 125 BN	North American Green
WintersStraw Bio	Winters Excelsior
Excel SR-1 All Natural	Western Excelsior

***Products with UV degradable netting not to be installed after September 1st**

Class I Type B

PRODUCTS	MANUFACTURER
Curlex High Velocity	American Excelsior
AEC Premier Straw DN	American Excelsior
Curlex II	American Excelsior
Curlex II CL	American Excelsior
Curlex LT	American Excelsior
AEC Premier Straw/Coconut	American Excelsior
ECS-2	East Coast Erosion Blankets
*ECS-2D	East Coast Erosion Blankets
ECM S2000	Enviroscape
*ECM S2000D	Enviroscape
EG-2S	Ero-Guard
S32	Erosion Control Blanket.com
ETRS-2	Erosiontech
ProGuard DS	Erosion Control Systems
S150	North American Green
DS150	North American Green
SC 150	North American Green
Landlok CS2	Propex
Landlok S2	Propex
DNS	SoilTex
V 150 S	Verdyol
Excel SS-2	Western Excelsior
*Excel SS-2 Rapid Go	Western Excelsior
*Winters Straw HVW	Winters Excelsior
Winters Straw HVG	Winters Excelsior
Winters Choice HV	Winters Excelsior

Class 1, Urban, Type B

PRODUCTS	MANUFACTURER
Curlex NetFree	American Excelsior
EXCEL SS-2 All Natural	Western Excelsior
Erosion Control Blanket.com	S32BD

ANCHORING DEVICES FOR CLASS I, URBAN EROSION MAT

PRODUCTS	MANUFACTURER
E-Staple	American Excelsior
CF Bio Staple	CFM Corp.
Green Stake	Green Stake
Bio-Stake	North American Green
Enviro-Stake	ODC Inc.

***Products with UV degradable netting not to be installed after September1st**

CLASS II

A long term duration (3 years or greater), Coconut Fiber, "Erosion Control

Revegetative Mat" (ECRM).

The weight of the netting shall not exceed 15% of the total blanket weight. The netting shall be bonded sufficiently to the parent material to prevent separation of the net from the parent material for the life of the product. This is particularly important as the vegetation starts to grow. If found deficient at the bond the product will be removed from the PAL. The net if not bonded sufficiently, has a tendency to float as the vegetation grows and may cause damage to maintenance equipment when slopes are mowed and increases the risk of animals being caught in the netting. All Type II mats shall have a C factor from the Revised Universal Soil Loss Equation of 0.1 or less.

TYPE A - Jute fiber only

Jute shall conform to the Wisconsin Department of Transportation Standard Specifications for Highway and Bridge Construction section 628.2.2. This netting is used for reinforcing sod. No approval is required for this Class and Type.

TYPE B

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): For use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less. Non-organic, photodegradable or biodegradable netting allowed.

TYPE C

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): For use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less. Only 100% organic fibers allowed. Woven mats are allowed with a maximum opening of ½ inch (12 mm). **Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting.**

Class II Types B& C Fiber Longevity

The parent material of Class II Type B & C mats shall have a maximum water absorption rate of 300%, by weight, as per ASTM D1117; and a maximum swell (wet thickness change) of 30% as per ASTM D1777. The lignin content shall be greater than or equal to 33%, as determined by the [1]1Klason Method.

[1]Technical Association of the Pulp and Paper Industry Test Method**,** Acid Insoluble lignin in wood and pulp, T222 om-98 method

CLASS II TYPE A

100% Jute Mats only no specific products identified or approved. See 628.2.2 of the Wisconsin Department of Transportation Standard Specifications for specific requirements, used for sod Reinforcement.

CLASS II TYPE B

PRODUCTS	MANUFACTURER
AEC Premier Coconut	**American Excelsior**
C 32	**Erosion Control Blanket.com**
C4000	**Enviroscape**
C 125	**North American Green**
C 125 BN	**North American Green**
C 350	**North American Green**
LandLock C 2	**SI Geosolutions**
DNC	**SoilTex**
V 125 C	**Verdyol**
WintersCoir HV	**Winters Excelsior**
Excel CC-4	**Western Excelsior**

CLASS II TYPE C

PRODUCTS	MANUFACTURER
Dekowe 700	**Belton Industries**
Dekowe 900	**Belton Industries**
BioD-Mat 70	**RoLanka**

CLASS III

A permanent, 100% synthetic "Erosion Control Revegetative Mat" (ECRM) or "Turf Reinforcement Mat" (TRM).

Class II Type A mats are required to provide a C factor from the Revised Universal Soil Loss Equation of 0.10 or less. Class II Type B, C, and D shall provide a C factor from the Revised Universal Soil Loss Equation of 0.20 or less

WisDOT DEFINITION OF TRM and ECRM: TRM's are designed to be filled with soil when installed. ECRM's are designed to be placed on top of soil. TRM's shall be continuously bonded at the filament intersections. Filaments, which are discontinuous or loosely held together by woven, stitched or glued, netting, for example, will not be permitted in this category.

TYPE A

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa): An ECRM mat, as opposed to a TRM mat, for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less.

TYPE B

(Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95 Pa)): A TRM mat for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95 Pa) or less.

TYPE C

(Minimum Product Permissible Shear Stress: 3.5 lbs/ft² (170 Pa)): A TRM mat for use on slopes 2:1 or flatter, or in channels when the calculated (design) shear stress is 3.5 lbs/ft² (170 Pa) or less.

TYPE D

(Minimum Product Permissible Shear Stress: 5.0 lbs/ft² (240 Pa)): A TRM mat for use on slopes 1:1 or flatter, or in channels when the calculated (design) shear stress is 5.0 lbs/ft² (240 Pa) or less.

TRM'S REQUIRED MINIMUM THICKNESS AND AREA HOLDING CAPACITY:

TRM Categories	**Minimum Thickness mm (Inches)**	**Minimum Area Holding Capacity L/m^2 (In^3/Yd^2)**
Type B	10(0.4)	8.8 (450)
Type C	18(0.7)	17.6 (900)
Type D	18(0.7)	17.6(900)

Class III - Type B, C and D "Turf Reinforcement Mats" (TRM) are permanent, 100% synthetic, open-weaved mats that shall be continuously bonded at the filament intersections. **WisDOT requires that all classes of TRM mats shall be completely filled with topsoil immediately after installation.** Loosely packaged discontinuous filaments are not permitted in this category.

To prevent initial soil loss, Class III TRM mats, Type B, Type C, and Type D, must be covered with one of the following materials during installation: (These materials shall be considered **incidental** to the installation of Class III TRM mats)

FOR SLOPE APPLICATION

1. An approved Soil Stabilizer Type A

2. An approved ECRM mat for slope applications

FOR CHANNEL APPLICATION

1. An approved ECRM mat for channel applications

APPROVED CLASS III TYPE EROSION MATS

Class III Type A

PRODUCTS	MANUFACTURER
Pek Mat	American Excelsior
Recyclex	American Excelsior
Recyclex TRM V	American Excelsior
Miramat 1800	Nicolon Mirafi
Miramat2400	Nicolon Mirafi
P550	North American Green
P300	North American Green
Contech C-45	SI Geosolutions
Contech C-60	SI Geosolutions
TB 1000	Tensar
Landlok 450	Propex
Landlok 1060	Propex

Class III Type B

PRODUCTS	MANUFACTURER
Enkamat 7010	Colbond Geosynthetics
Enkamat 7018	Colbond Geosynthetics
MacMat N10	Maccaferri
TM3000	Tensar

Class III Type C

PRODUCTS	MANUFACTURER
Enkamat 7020	Colbond Geosynthetics
MacMat N20	Maccaferri
Landlok 300	Propex

Class III Type D

PRODUCTS	MANUFACTURER
Enka S	Colbond Geosynthetics
Pyramat	Propex

TACKIFIERS

The list shown below is WisDOT's Product Acceptability List (PAL) for Tackifiers. Products in this category must meet or exceed the minimum requirements of Michigan Department of Transportation's Qualified Product List. WisDOT **will not** approve any **asphalt based** products or any product deemed environmentally incompatible. Tackifiers shall be mixed and applied in accordance with the manufacturers published directions.

General Specifications

1. Latex-Base: The components for the latex-base adhesive shall meet the following requirements: The composition, by weight, of the latex emulsion polymer shall be 48 percent Styrene, 50 percent Butadiene, and 2 percent additive; 42.0-46.0 percent solids; and a PH, as shipped, of 8.5 to 10.0. The emulsion shall not be allowed to freeze or to be exposed to sunlight for a prolonged period of time.

2. Guar Gum. Guar gum tackifiers shall consist of a minimum of 95% Guar gum by weight; the remaining shall consist of dispersing and cross-linking additives.

3. Other Tackifiers. Other tackifiers shall include the following but not limited to: water soluble natural vegetable gums or guar gums blended with gelling and hardening agents or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums.

Construction Methods

Mulch Anchoring. Anchoring of the mulch shall be accomplished by spraying the tackifier immediately after the mulch has been placed. Spraying shall not be performed during periods of windy conditions that would prevent the proper placement of adhesive. The Contractor shall protect all traffic, signs, structures, and other objects from being marked or disfigured by the tackifier material. The tackifiers shall be applied at the following minimum rates per hectare:

1. Latex-Base: mix 37 gal (140 L) of adhesive or the manufacturers recommended rate whichever is greater with a minimum of 620 LB (280 kg) of Recycled Newsprint as a tracer with 925 gallons (3.5 kl) of water.

2. Guar gum: mix 120 LB (55 kg) of dry adhesive and a minimum of 620 LB (280 kg) of Recycled Newsprint as a tracer with 3,225 gallons (12.2 kl) of water.

3. Other Tackifiers: (Hydrophilic Polymers) mix 110 kg (240 LB) of dry adhesive or the manufacturer's recommended rate whichever is greater and a minimum of 280 kg (620 LB) recycled newsprint as a tracer with 3,225 gallons (12.2 kl) of water.

APPROVED TACKIFIERS

LATEX BASE ADHESIVE

PRODUCTS	MANUFACTURER
BUTOFAN NS 268	BASF Corp.

GUAR GUM BASE ADHESIVE

PRODUCT	MANUFACTURER
Lawn Tack	Amturf Seeds
Second Nature Tacpac GTX	Central Fiber Corp.
Landtack	Erosion Control Technologies
Eco Tak-OP	Eastern Products Inc.
Finn A500 Hydro-Stik	Finn Corporation
Landtack Guar	Innovative Turf Solutions
GG Tack	Innovative Turf Solutions
Hydra Glue	Innovative Turf Solutions

OTHER TACKIFIERS (Hydrophilic Polymers)

PRODUCT	MANUFACTURER
Exact-Tac (E-T)	American Excelsior Co.
Con-Tack A/T	Con Wed
Eco Tak-SAT	Eastern Products Inc.

SOIL STABILIZERS

Soil stabilizers are intended as soil bonding agents to prevent or minimize erosion of bare soil. They must be harmless to fish, wildlife, and plants, along with being non-toxic and non-combustible.

General Requirements for Soil Stabilizers

Manufacturers of Soil Stabilizers may request approval of their products by supplying:

1. Acute and chronic toxicity test reports from an accredited testing laboratory. The toxicity test report shall be reviewed and a use restriction issued by the Wisconsin Department of Natural Resources (WDNR).
2. Certified test data showing the products ability to reduce soil loss induced by a rainfall simulator, as detailed in the **American Association of State Highway and Transportation Officials National Transportation Evaluation Program (2, 4, 6 inch per hour)**

The outcome of the WDNR review and the test results shall determine whether or not a product is placed in the PAL. All products must have a label identifying the product and date that this product was manufactured.

Asphalt based products will not be approved for use as soil stabilizers.

Soil stabilizers are considered a short term duration (6 months or less) erosion control device. When used alone, they shall be used on slopes 3:1 or flatter. They shall **not** be used in channels.

TYPE A

Soil stabilizer, Type A, shall be a cementitious soil binder added to wood cellulose fiber mulch, or a bonded fiber matrix. They are intended to form a thick heavy bodied crust or mat like barrier that controls water and wind induced erosion. Soil Stabilizer, Type A, is approved for use as a temporary cover on Class III, Type B, C, and D soil filled turf reinforcement mats on slope applications. In addition to the above requirements soil stabilizers must show equal vegetative density and sediment loss standards as Class I erosion mats. Certified large-scale test data conforming to ASTM D6459 as modified in the Erosion Mat General specifications starting on page 1 of this document.

TYPE B

Soil stabilizer, Type B, shall be a flocculent intended to reduce the erodibility of bare soils during construction activities or to enhance the performance of mulching on permanent slopes. Soil stabilizer, Type B, shall have proven abilities to bond soil particles, effectively increasing the soil particle size to 1.0 mm or larger. It shall reduce the movement of soil through chemical bonding, increase the particle size thus making silt fence more effective, and increase the water absorption of the soil. Testing should show that the product works in a range of soil including acidic soil with a ph of 5.

Only the anionic form of polyacrylamide PAM shall be used. Cationic PAM is toxic and shall not be used. PAM and PAM mixtures/additives shall be environmentally compatible, harmless to fish, wildlife and plants. They shall be non-combustible. Detailed information on all additives shall be provided to the Wisconsin Department of Transportation.

Anionic PAM, in pure form shall have no more than 0.05% acrylic monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency. To maintain the ≤ 0.05% acrylic monomer content, the application rate for PAM, in its pure form, on slopes and channels, shall not exceed 200 lbs/acre (224 kg/ha).

Soil loss in large scale ASTM D6459 testing not to exceed a Cover Management (C) Factor of 0.50 as defined in the Revised Universal Soil Loss Equation (RUSLE) from the USDA-ARS Agricultural handbook 703.

Construction Methods for Type A and B

1. Application for Soil Stabilizer, Types A & B is intended to be done with conventional hydraulic seeding equipment. Soil Stabilizer, Type B, may also be placed through dry spreading. When dry spreading is used, the contractor must ensure that the material is applied uniformly. The manufacturer shall provide detailed instructions on the storage, mixing and application procedures to insure proper safety and effectiveness of the product.

2. Soil Stabilizer Type B when hydraulically applied typically need time in solution to allow polymer chain to unwind, refer to manufactures instructions for time recommendations.

3. For optimum performance of soil stabilizers Type B, soils that are either very acidic or very basic should be brought closer to a ph of 7.0, refer to manufacturers' recommendations.

4. Seeding must be done in a manner that ensures direct contact with the soil. For Soil Stabilizer, Type A, seed must be sown separately and prior to the application of the soil stabilizer.

5. Minimum application rates shall be as noted in the chart based upon submitted performance testing regardless of other application rates recommended by the manufacturer.

6. For Soil Stabilizer, Type B, when used on permanent slopes, WisDOT approved mulch must be applied in addition to the Soil Stabilizer Type B to protect the seed.

[1] AASHTO NTPEP Project Work Plan for Laboratory Evaluation of Erosion Control Products (ECP) , 2012.

APPROVED SOIL STABILIZERS

TYPE A

Products	Manufacturer	Application Rate (minimum)
Airtrol Plaster (to be used only in combination with a wood mulch)	**US Gypsum Company**	**4500 lb/ac in addition to 1650 lb/ac of a standard processed wood fiber mulch**
Soil Guard	**Mat, Inc.**	**3500 lb/ac**
Hydra CX-2	**North American Green**	**3500 lb/ac**
Hydra CM	**North American Green**	**3500 lb/ac**
Bindex	**American Excelsior**	**3200 lb/ac**

TYPE B

CF 2000	**Construction Fabrics and Materials**	**20 lb/ac**
Natural Earth PolyStable Plus	**Earth & Road**	**20 lb/ac**
PolyPlus	**Polymer Plus, LLC**	**20 lb/ac**
TRIPAM	**Soilnet**	**54 lb/ac**
35	**Soilnet**	**54 lb/ac**
50	**Soilnet**	**54 lb/ac**
B100	**Agrecol**	**20 lb/ac**
PAM-12 Plus	**ENCAP**	**2000 lb/ac**

INLET PROTECTION

General Requirements of Inlet Protection

Application

Inlet protection products are intended to intercept, pond, and filter sediment-laden runoff. They generally consist of geotextile fabric and fabric hold down systems for inlet protection as shown on the Department's details or plans. All fabrics used as part of an inlet protection must be included on the list of fabrics certified for Inlet Protection, Geotextile Fabric, Type FF in the current edition of the PAL. Approved manufactured products used as alternatives to the Department's Standard Details are listed below will also be manufactured of Type FF Fabric.

The Department will include a listing of acceptable fabrics for Inlet Protection, Geotextile Fabric, Type FF in the Product Acceptability List. To be considered for certification, suppliers or manufacturers of geotextiles must submit products to the Department.

Materials

Product acceptance will be based on compliance with the following requirements.

Product Material: Woven polypropylene.

Physical Properties:

Test	Method	Value[(1)]
Grab Tensile Strength, lb. (N)	ASTM D-4632	200 (900) min.
Puncture Strength, lb. (N)	ASTM D-4833	105 (460) min.
Apparent Breaking Elongation,	ASTM D-4632	24 min.
Apparent Breaking Elongation,	ASTM D-4632	
Machine Direction, %		10 min
Cross Direction, %		
Apparent Opening Size, μm	ASTM D-4751	600 max.
Permittivity, s^{-1}	ASTM D-4491	1.9 min.

[(1)]All numerical values represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

Certification Procedures

To be considered for certification, the supplier or the manufacturer must supply the PAL Committee with the following items for each product submitted.

1. Certified Report of Test and Analysis showing full compliance with the listed requirements.

2. Private label identification: Provide a letter from the private labeler identifying his source and name of material along with a companion letter from the manufacturer. Material properties and identifying names shall be included in the letters of certification.

3. Three samples of the material obtained from separate rolls of material. Each sample shall be a minimum of 3 feet in length and the full width of the roll.

Product acceptability will be determined by Department under the administration of the PAL Committee. No product will be considered for certification without the receipt of an acceptable Certified Report of Test and Analysis. In addition, the Department will conduct laboratory testing of the received samples. Initially, two of the received samples will be tested for compliance with the listed requirements. If both samples are in full compliance, the product will be certified. If both samples fail to meet full compliance, the product will be rejected. If one of the samples fails to meet full compliance, the third sample will be tested and certification or rejection will be based on the test results of that sample.

Field Control

The contractor has the responsibility of providing identification of the fabric supplied for inlet protection units. Such identification shall be attached to the unit and shall allow the project manager to determine if the supplied material is on the list of certified materials for Inlet Protection, Geotextile Fabric, Type FF contained in the current PAL. Field samples are not required as part of the standard project material acceptance as these fabrics are sensitive to sampling techniques that may alter the material properties tested for conformance.

TYPE A

Inlet protection Type A shall be utilized around field inlets until permanent stabilization methods have been established. Inlet protection Type A shall be utilized on pavement inlets prior to installation of curb and gutter or pavement.

TYPE B

Inlet protection Type B shall be utilized on street inlets without curb head, once surrounding surfaces are in place.

TYPE C

Inlet protection Type C shall be utilized on street inlets with curb heads. A 1 ½" x 3 ½" (37mm by 87 mm) minimum, piece of wood shall be wrapped and secured in the fabric and placed in front of the curb head as shown in the plans. The wood shall not block the entire opening of the curb box.

TYPE D

Inlet protection Type D shall be utilized in areas where other types of inlet protection are identified as incompatible with roadway and traffic conditions causing possible safety hazards when ponding occurs at the inlet. The inlet protection shall conform to the standard detail drawing as shown in the plans.

APPROVED INLET PROTECTION

Must use an approved FF Fabric

TYPE A

PRODUCT	MANUFACTURER
Verti – Pro	Alpine Stormwater Management Co.
Grate Inlet Protector, PCD-1000	Suntree Isles Inc.

TYPE B

PRODUCT	MANUFACTURER
Dandy Bag	Dandy Products Inc.

TYPE C

PRODUCT	MANUFACTURER
Slammer	Alpine Stormwater Management Co.
Beaver Dam	Dandy Products Inc.

Type D

PRODUCT	MANUFACTURER
Siltsac	ACF Environmental
The Catch-All (WisDOT Model)	Marathon Materials Inc. (Mar Mac)
The Road Drain Curb and Gutter High Flow	WIMCO
Inlet Protection	Lange Industries
FLEXSTORM (WisDOT Model)	Inlet & Pipe Protection, Inc. (IPP)

GEOTEXTILE FABRIC TYPE FF

PRODUCT	MANUFACTURER
WevTex 403	Kintex
GTF 403	Linq
W401	TNS
TerraTex EP12	WebTec

TEMPORARY DITCH CHECKS

Purpose & Operation

Products in this category are intended for use at the bottom of fill slopes and in channels to intercept and pond sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the sediments to settle out. Water exits the check by either filtering through or flowing over the top.

Construction Methods

This work shall be in accordance with the requirements of the State of Wisconsin Department of Transportation Standard Specification for Highway and Structure Construction, and the Standard Detail Drawing in the WisDOT Facility Development Manual. In addition to the above, temporary ditch checks shall be placed perpendicular to the flow line of the ditch and shall extend far enough so that the ground level at the ends of the checks are higher than the low point on the crest of the check. The installed material shall have a minimum height of 10 inches above the flow line in the installed condition. All products shall be entrenched a minimum of 2.0 inches on bare soil. Ditch checks installed in a channel that is continuously lined with erosion mat need not be entrenched if installed over the top of the erosion mat. Installations shall have stakes on the downstream side of the temporary ditch check and shall not reduce the height of the temporary ditch check. Fabric type products may be entrenched with a narrow check slot on the upstream side.

Approved manufactured alternatives to the Department's details are listed below.

APPROVED TEMPORARY DITCH CHECKS

PRODUCT	MANUFACTURER
Curlex 12 inch Sediment Log	**American Excelsior**
Curlex 20inch Sediment Log	**American Excelsior**
AEC Premier 12 inch Wattle	**American Excelsior**
AEC Premier 20 inch Wattle	**American Excelsior**
Stenlog 12	**Erosion Control Blanket.com**
Triangular Silt Dike	**Triangular Silt Dike**
Aspen Xcel Excelsior Log	**Western Excelsior**
Ditch Chexx	**Filtrexx**
Bio-D Silt Check	**Ro Lanka**
WS-12	**North American Green**

IN-STREAM SEDIMENT TRAP

Purpose & Operation

In-Stream sediment traps are intended for use in streams or channels to trap and remove or stabilize sediments during in-stream construction activities. The product consists of a flat pad with protruding vanes designed to trap sediment within the confines of a concentrated flow area or stream. The pad, which is placed singularly or in a group on the stream-bed immediately downstream of a disturbed area, filters out the sediment carried by the stream current or water runoff.

Construction Methods

Mats shall be placed at locations shown on the plans or as directed by the engineer. Mats shall be installed flat on the stream bed to intercept and retain sediments caused by in stream activities. It shall be anchored by staking or other methods approved by the engineer. Overlap of the trailing edge of upstream mats and sides of adjacent mats shall be a minimum of 6 inches or 150 mm. When ordered by the engineer, mats shall be replaced or removed. Care shall be taken during removal to minimize loss of entrapped sediments.

These products shall only be used in streams with the concurrence of WisDNR.

APPROVED IN-STREAM SEDIMENT TRAP

PRODUCT	MANUFACTURER
Sedimat	**Indian Valley Industries**

Articulated Concrete Block Revetment Systems

Purpose & Operation

Articulated concrete block revetment systems are a flexible manufactured erosion control system that is able to expand and contract with the subgrade. The systems are made of individual concrete block units, which are physically integrated through mechanical interlock, cables, grids, or other means to produce an erosion-resistant lining. The articulated concrete blocks are organized into five types based upon sustaining a minimum permissible shear stress.

General Specifications

1. Bed Shear Stress: All articulated concrete block systems are placed in categories based upon performance at an adequate testing facility meeting protocols and procedures as described in this section. In order to be placed in a particular category, an articulated concrete block system must perform to a minimum product permissible bed shear stress in a channel and meet the minimum permissible bed shear stress for that category. For example, articulated concrete block systems placed in an Open Class Type E category must withstand a minimum product permissible bed shear stress of 1425Pa (30 lbs/ft^2). See item #2 under the general specifications for specific testing requirements and documentation.

2. Testing Procedure and Documentation: All articulated concrete block systems must be tested in accordance with FHWA-RD-88-181 or FHWA-RD-89-199 and a minimum slope of 2:1 prior to being placed on WisDOT's Erosion Control Product Acceptability List (PAL). Articulated concrete block systems must be installed as tested. This includes anchors, drainage nets, and cables.

It is recognized by WisDOT that some systems utilize a cable for installation purposes. However it is also possible that the cable can enhance the performance of the system. Therefore, any system, which is tested with a cable and placed in a specific category, must be installed with a cable. This does not prevent systems, which were not tested with cables to be installed with cables. Articulated Concrete Block Revetment systems, which do not have a positive interlock at least in one direction, are required to use cables for installation and testing. Positive interlock is defined as block that is united firmly in a direction of forward motion such as by hooking or dovetailing.

It is also recognized by WisDOT that some testing facilities will use a turf reinforcement mat similar to a Class III Type D in order to place water monitoring devices required for the testing. This practice is consistent with the procedure that was completed in the FHWA-RD-89-199 report. Mats or other devices used for this purpose will not be required in the field.

The hydraulic conditions at the threshold of failure determine the hydraulic stability of a systems performance. Failure of a system is defined as the "loss of intimate contact between an articulating concrete block system and the subgrade soil"

All systems must be tested as full scale production units in order for extrapolation to be accepted for inclusion on WisDOT's PAL. To be considered for WisDOT's Erosion Control Product acceptability List, the following reporting information is required to be performed at an independent testing facility and reported by a licensed professional engineer.

- Description of the testing facility, including plan/profile schematics, water management scheme, measurement devices and instrumentation, and maximum flow capabilities.
- Description of revetment system, including dimensioned drawings of block components, description of infill material (if used), geotextile properties, and any ancillary features such as cables, anchors, connectors, etc.
- Computations and a diagram of a 10 foot by 10 foot area of the system determining percent open area measured at the bottom of the block.
- Documentation of embankment soil properties and description of embankment construction methods.
- Description of revetment installation, including wall details, crest and toe terminations, method of interlock, and ancillary components such as anchors, cables, grids etc. Include photographs illustrating relevant aspects.
- Description of the testing procedures, including the overtopping depth(s) and discharge(s) examined, data collection procedures, and qualitative description of revetment system performance. Include photos of tests in progress and post test revetment system condition.
- Summary of measured data and calculated hydraulic conditions for each test.
- Discussion of the identification (interpretation) of stability threshold location and hydraulic conditions, with supporting calculations.
- Calculations of any extrapolated data for revetment systems of varying thickness of the same family of block. Note that extrapolation will only be accepted from testing on full scale production units.
- Appendix containing raw data and measurements.

3. Materials

General: The articulated concrete block revetment system and all materials used to manufacture the system shall have a minimum effective life span of 50 years.

Concrete: The concrete used to manufacture the individual blocks shall meet a compressive strength of 4000 psi using ASTM-C-140 for dry cast products and ASTM-C-39 for wet cast products. Cast concrete blocks shall conform to ASTM-C-1262 in a 3% saline solution at forty (40) cycles and not to exceed a 1% loss of its initial weight. or shall conform to ASTM C 666, the block shall retain 80% of the relative dynamic modulus with no more than 1% loss of initial weight. Compliance with theseprocedures shall be accomplished by certification from an AMRL (A.A.S.H.T.O. Material Registered Laboratory) certified plant. This Certification shall be done when a change is incurred in the mix design, supplying plant, and/or source materials in addition to yearly recertification.

Cable: For articulated concrete block systems that utilize cables during the testing procedure, the cables shall have a tested effective life span of 50 years. A minimum factor of safety of 5 shall be applied to the cables for lifting and placing purposes.

4. Installation: Articulated concrete block systems shall be built in a reasonably close conformity to the lines, grades, dimensions, details and design indicated on the plans in accordance with the pertinent requirements of the specifications for all work necessary to complete the work in accordance to the contract. The contractor will be responsible for supplying the department with the design of anchor trenches, side trenches and toe trenches to ensure a surface that is flush with the top surface of the articulating concrete mat.

5. Filter Fabric: All articulating concrete mats approved for WisDOT use shall be installed with a filter fabric beneath the mat that meets the following specifications.

TEST	METHOD	VALUE
Grab Tensile Strength	ASTM D 4632	1450 N (320 lbs) min
Puncture Strength	ASTM D 4833	510 N (115 lbs) min
Apparent Breaking Elongation	ASTM D 4632	26% min Machine Direction
Apparent Breaking Elongation	ASTM D 4632	15% min Cross Direction
Apparent Opening Size	ASTM D 4751	600um (30 US Std. Sieve)
Permittivity	ASTM D 4491	2.14 sec^{-1}
Permeability	ASTM D 4491	.142 cm/sec

[1]All numerical values represent minimum average roll values (i.e., the average of the minimum test results on any roll in a lot should meet or exceed the minimum specified values.

7. Recertification: To remain on the approved list all block suppliers must resubmit freeze thaw and strength testing by an approved AMRL lab by October first of each year.

8. Quality Assurance: For quality assurance WisDOT will conduct random tests on selected projects to determine if the supplied blocks meet the specifications. If they do not meet the specifications, the project engineer will determine a credit to the project in accordance with section 105.3 of the State of Wisconsin, Standard Specifications for Highway and Structure Construction. The credit will not exceed the cost of replacement of the blocks including labor of installation, and removal of the old blocks. Subsequently the block supplier / manufacturer will be removed from the list

Class and Type Specifications

Class Open Cell

(Open cell articulated concrete block systems must have a minimum open area of 20% measured at the bottom of the block for the system.)

Type A: (Minimum Product Permissible Bed Shear Stress: 240 Pa (5 lbs/ft^2)
Type B: (Minimum Product Permissible Bed Shear Stress: 475 Pa (10 bs/ft^2)
Type C: (Minimum Product Permissible Bed Shear Stress: 715 Pa (15 lbs/ft^2)
Type D: (Minimum Product Permissible Bed Shear Stress: 950 Pa (20 lbs/ft^2)
Type E: (Minimum Product Permissible Bed Shear Stress: 1425 Pa (30 lbs/ft^2)

Class Closed Cell

(Closed Cell articulated concrete block systems are systems that have a maximum open area of 10% measured at the bottom of the block in the system.)

Type A: (Minimum Product Permissible Bed Shear Stress: 240 Pa (5 lbs/ft^2)
Type B: (Minimum Product Permissible Bed Shear Stress: 475 Pa (10 bs/ft^2)
Type C: (Minimum Product Permissible Bed Shear Stress: 715 Pa (15 lbs/ft^2)
Type D: (Minimum Product Permissible Bed Shear Stress: 950 Pa (20 lbs/ft^2)
Type E: (Minimum Product Permissible Bed Shear Stress: 1425 Pa (30 lbs/ft^2)

-

APPROVED ARTICULATED CONCRETE BLOCK REVETMENT SYSTEM

Closed cell

TYPE A

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 45 S	Armortec	Americast Concrete Products
Armorflex 55 S	Armortec	Americast Concrete Products
Armorflex 45	Armortec	Americast Concrete Products
Armorflex 55	Armortec	Americast Concrete Products
Armorflex 75	Armortec	Americast Concrete Products
Armorflex 85	Armortec	Americast Concrete Products

Type B

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 45 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 55 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 45	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 55	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 75	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 85	Armortec	Americast Concrete Products, Woodstock, IL

Type C

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 55 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 45	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 55	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 75	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 85	Armortec	Americast Concrete Products, Woodstock, IL

TYPE D

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 45	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 55	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 75	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 85	Armortec	Americast Concrete Products, Woodstock, IL
CC 20	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN

TYPE E

Product	Manufacturer	Plant Name / location
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 55	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 75	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 85	Armortec	Americast Concrete Products, Woodstock, IL
CC 35	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN
CC 45	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN
CC 70	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN
CC 45 OS	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN
CC 65 OS	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN
CC 90 OS	Cable Concrete	Royal Concrete Pipe Products, Stacey, MN

Open cell

TYPE A

Product	Manufacturer	Plant Name / location
PL-41216 Geolink	Petratech	Americast Concrete Products, Woodstock, IL
PL-61216 Geolink	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 30 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 40	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 60	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 70	Armortec	Americast Concrete Products, Woodstock, IL
TYPE BProduct	**Manufacturer**	**Plant Name / location**
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 50 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 40	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 60	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 70	Armortec	Americast Concrete Products, Woodstock, IL

TYPE C

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 30 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50 S	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 40	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 60	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 70	Armortec	Americast Concrete Products, Woodstock, IL

TYPE D

Product	Manufacturer	Plant Name / location
Geolink PL-41216	Petratech	Americast Concrete Products, Woodstock, IL
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 40	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 50	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 60	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 70	Armortec	Americast Concrete Products, Woodstock, IL

TYPE E

Product	Manufacturer	Plant Name / location
Geolink PL-61216	Petratech	Americast Concrete Products, Woodstock, IL
Armorflex 50	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 60	Armortec	Americast Concrete Products, Woodstock, IL
Armorflex 70	Armortec	Americast Concrete Products, Woodstock, IL

Appendix A:

PRODUCT EVALUATION

Wisconsin Department of Transportation

DT2164 6/2005 Ch. 84 Wis. Stats.

Trade Name of Product	Description - What is it?	Date Submitted

RECOMMENDED USES

1. Primary

2. Alternate

Outstanding Features or Advantages Claimed

Manufacturer	Address	City	State	ZIP Code

Representative – Name and Firm	Address and Telephone Number	City	State	ZIP Code

PRODUCT STATUS

New on Market ☐ Yes ☐ No	Year First Introduced	Introduced as Alternate For

PRODUCT INFORMATION

1. Composition

2. Cost

3. Specifications

Furnished by Manufacturer ☐ Yes ☐ No	Availability of Specifications ☐ Attached ☐ To be Mailed ☐ Not Available
Product Meets the Following Standard Specifications ☐ AASHTO ☐ ASTM	☐ Federal ☐ Other:
4. Patented ☐ Yes ☐ No ☐ Applied For	5. Proprietary Product ☐ Yes ☐ No Royalty Costs:
6. Product Guaranteed ☐ Yes ☐ Copy Attached ☐ No	
Conditions	
7. Will Free Sample be Furnished? ☐ Yes ☐ No	Laboratory Analysis Furnished with Sample? ☐ Yes ☐ No
8. Other Highway Agencies Approving its Use	

ADDITIONAL INFORMATION

(Attach pages for additional information if necessary.)

Name of Person Furnishing Information	Title

(Authorized Signature) (Date)

For consideration by the Wisconsin Department of Transportation, submit the original of this form to the person contacted in the Department. The name and address is:

CHANNEL EROSION CONTROL MATRIX

(Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE															REMARKS
		< 2%			2% - 4%			4% - 6%			6% - 9% *			9% - 12% *			
		Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			
		300	600	1200	300	600	1200	300	600	1200	300	600	1200	300	600	1200	
Seed with properly anchored mulch	0.6																Anchor mulch per specifications.
Sod ditch checks with seed and mulch	N/A					C											Install one ditch check for every 1 foot of drop. Sod stakes required.
Temporary ditch checks (hay bales or approved manufactured alternatives lisited in the WisDOT PAL)	N/A																Install one ditch check for every 2 feet of drop. Maximum 200' spacing. Not recommended for slopes less than 1%.
Sod ditch liner	1.0																Upstream end must be buried. Additional sod stakes required.
Double netted light duty (WisDOT Class I Type B) erosion mat	1.5																Only mat type products allowed.
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat	1.5																Upstream end must be buried. Additional sod stakes required. Two bid items needed.
Stone or rock ditch checks, or Rock-Filled Filter Bags	N/A																Use No. 2 coarse aggregate, railroad ballast, or breaker run. Install one ditch check for every 2 feet of drop. Use in conjunction with a channel lining.
Medium duty coconut erosion mat (WisDOT Class II Type B or C)	2.0																
Heavy duty synthetic (WisDOT Class III Type A) erosion mat or turf reinforcement mat (WisDOT Class III Type B)	2.0																Germination may be a problem with Class III Type A mats. An ECRM is required for initial erosion protection for Class III Type B mats.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type C) mat	3.5																An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.
Riprap ditch checks	N/A																Place top of downstream ditch check level with bottom of upstream ditch check. Use in conjunction with a channel lining.
Heavy duty synthetic turf reinforcement (Class III Type D) mat	5																An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.
Light riprap	4																Outfalling, overtopping and scour need to be addressed. Use 2' minimum ditch depth.
Medium riprap	5																
Heavy riprap	8																
Riprap measures apply to all ditch types. Use of these measure requires engineering judgement and design.																	

CHANNEL EROSION CONTROL MATRIX

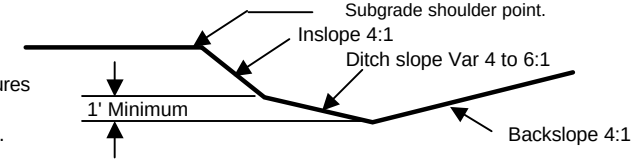
(Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE															REMARKS
		< 2%			2% - 4%			4% - 6%			6% - 9% *			9% - 12% *			
		Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			
		300	600	1200	300	600	1200	300	600	1200	300	600	1200	300	600	1200	
Grouted rip rap	N/A	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Address outfalling, overtopping and scour. Line with Grotextile fabric Type "HR", (see Chap. 10, Const. Detail and special provision). Use 2' minimum ditch depth.
Articulated Concrete Block Type A	5	●	●	●	●	●	●	●	●	●	●						ACBs apply to all ditch types. Use of these measures requires engineering judgement and design.
Articulated Concrete Block Type B	10	●	●	●	●	●	●	●	●	●	●	●	●	●			
Articulated Concrete Block Type C	15	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Articulated Concrete Block Type D	20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Articulated Concrete Block Type E	30	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	

Standard Ditch Section

●

Erosion control for ditches not conforming to the typical at right, that complies with FDM procedures 11-15-1 Figures 6 & 7, should be designed according to FDM Chapter 13.



KEY

Effective range of device for Sandy or Clayey Soil: ●

Device applicable, may not be cost effective: ●

" C " effective for clayey soil only

Not applicable. Use in conjunction with other BMPs: ⊗

ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.
TRM - Turf reinforcement mat.
FDM - WisDOT Facilities Development Manual
BMP - Best Management Practice
PAL - See Note 6

* For ditch grades over 9% special design considerations may be required.
** Soils that are not sandy should be treated as clay soils.

NOTES

1) Ditch flow rates used to develop bar chart are based on a 60 ft. right of way from pavement centerline and a 2-Yr. rainfall event for temporary liners or a 25-Yr. rainfall event for permanent (Class III mat or riprap) liners. If the drainage area extends outside the 60 foot right of way or unusual flows are expected, use the shear stress column values to determine the suitablity of a liner. See FDM procedures in Chapter 10 and in Section 13-30-10.
2) Erosion mats shall extend upslope 1.0 ft. min. vertically from the ditch bottom or 6" higher than the design flow depth. There shall be no joints within 18" of the low point.
3) Cost shall be a consideration in the selection of these devices.
4) Add sediment traps at the bottom of channel slopes.
5) Refer to FDM Chapter 10 for any channels exceeding the limits shown.
6) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: http://www.dot.wisconsin.gov/business/engrserv/pal.htm
7) On long or steep channels that require a higher class mat, use the appropriate lower class mat for the first 300 ft to 600 ft of the channel.
8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

SLOPE EROSION CONTROL MATRIX

TYPE OF EROSION CONTROL	SLOPE																		REMARKS
	6:1 or flatter (7)			4:1			3:1			2.5:1			2:1			1:1			
	SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			
	0 - 30'	30 - 60'	60 - 120	0 - 30'	30 - 60'	60 - 120	0 - 30'	30 - 60'	60 - 120	0 - 30'	30 - 60'	60 - 120	0 - 30'	30 - 60'	60 - 120	0 - 30'	30 - 60'	60 - 120	
Seed with properly anchored mulch																			
Single netted light duty (WisDOT Class I Type A) erosion mat																			
Light duty single netted 100% biodegradeable (WisDOT Urban Type A) erosion mat																			Use only 100% biodegradeable anchors for urban mats.
Light duty double netted 100% biodegradeable (WisDOT Urban Type B) erosion mat																			Use only 100% biodegradeable anchors for urban mats.
Bonded Mulch (WisDOT Type A Soil Stabilizer)																			May be applied over Class III Type B, C, or D mats in place of erosion control revegetation mats.
Polymer (WisDOT Type B Soil Stabilizer)	Used in conjunction with other BMPs effective up to a 2:1 slope. Not effective in sand. When used alone effective up to a 3:1 slope. Stand alone use appropriate for earthen stock piles, temporary, and late season applications																		
Double netted light duty (WisDOT Class I Type B) erosion mat																			
Sod																			
Medium duty coconut erosion mat (WisDOT Class II Type B or C)																			
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat																			Sod stakes required. Two bid items needed.
Heavy duty synthetic erosion control revegetation mat (WisDOT Class III Type A)																			Germination may be a problem with Class III Type A mats
Riprap																			Angle of repose must be considered, see FDM Chapter 13.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type B or C) mat																			A soil stabilizer or ECRM will be required for initial erosion protection.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type D) mat																			A soil stabilizer or ECRM will be required for initial erosion protection.
Slope paving or grouted riprap																			Consider clear zone requirements. Only use in limited circumstances such as overflow areas near bridges.

SLOPE EROSION CONTROL MATRIX

Benches	Consider benches when cuts exceed 20', bench at approximately 15' vertical intervals to collect and drain water. Treat benches as channels (ditches). Adjust elevations to provide drainage. Consider flumes at transitions.
Intercepting embankments	Used to intercept runoff from abutting lands. Flumes may be necessary to direct runoff.
Silt fence	Used at toe of slopes to intercept and detain small amounts of sediment. Use only WisDOT approved silt fence as listed in the PAL.
Temporary ditch checks or Erosion bales	Used at toe of slopes to intercept and detain small amounts of sediment.
Slope drains/flumes	May be necessary on slopes (see channel matrix for design guidance).
Sediment traps	Used to trap sediment laden runoff. Could be used at the inlet or outlet end of slope drain.

KEY:

Not applicable. Use in conjunction with other BMPs: ⊗

Effective range of device for Sandy or Clayey Soil: ●▬▬▬▬▬

Device applicable, may not be cost effective: ●▬▬▬▬▬

* Soils that are not sandy should be treated as clay soils.

ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.
TRM - Turf reinforcement mat.
FDM - WisDOT Facilities Development Manual
PAL - See Note 5

NOTES

1) Cost shall be a consideration in the selection of these devices.
2) Designers should review FDM Chapter 10 prior to selection of erosion mats.
3) Install intercepting ditches to limit slope lengths to 15' vertical intervals. (See FDM Chapter 10)
4) Refer to FDM Chapter 10 for any slopes exceeding the limits shown.
5) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: http://www.dot.wisconsin.gov/business/engrserv/pal.htm
6) On steeper slopes that require a higher class mat, use the appropriate lower class mat or seed and mulch for the first 30 ft to 60 ft of the slope.
7) Unless project conditions require otherwise, seed and mulch all slopes that are flatter than a 5% grade, regardless of length. If practicable, bench the slopes.
8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.