*CMM provisions mobilized by the contract:*

*CMM 6-45.2 ..... Erosion Control and Implementation (ECIP) preparation and submittal*

The department emphasizes practical roadside erosion control to reduce water pollution, soil erosion, and siltation of watercourses and adjacent lands. Environmental concerns necessitate advance planning, increased use of erosion control materials, and installation concurrently with grading operations, rather than as a final operation before acceptance of the work.

The department is committed to lessening adverse environmental impacts resulting from our projects. WisDOT policy is to construct projects according to standards that will minimize or negate erosion and/or sediment damage to the highway and adjacent properties, prevent surface water pollution, and prevent ground water contamination.

Standard spec 107.20 requires that continuous erosion control be practiced during and after construction using temporary or permanent measures such as seeding and mulching as shown on the plans or determined by the engineer. Temporary and permanent erosion control will be measured and paid as provided for the contract or as extra work, unless the need for temporary erosion measures stems from the contractor's negligence. The specification is designed to prevent damage to the environment caused by the construction or reconstruction of a publicly owned transportation facility.

### 6-45.1 Measures Taken Before Construction

According to Chapter Trans. 401 of the Wisconsin Administrative Code and standard spec 107.20 the contractor is required to prepare and submit a detailed erosion control implementation plan (ECIP) for the project, including borrow sites and material disposal sites. Special provisions may also require removal plans and/or clean-up contingency plans for removals over waterways.

Temporary and permanent erosion control measures proposed in the contractor's ECIP and schedule are discussed at the preconstruction conference. Refer to CMM 2-26.

Before the preconstruction conference, the engineer reviews the project plan, ECIP, and schedule, plus the environmental documents, to become fully aware of areas of environmental sensitivity and concern. Environmental commitments and permit requirements should be noted for compliance and implementation by WisDOT and/or the contractor.

Before construction begins, the engineer should discuss contract-required erosion control measures with the prime contractor. The prime contractor should be aware of the requirements of any erosion control items performed by the subcontractors, and the prime contractor's ultimate responsibility for all subcontractor actions. The prime contractor should also be made aware that the department will pay for all reseeding and refertilizing made necessary by factors beyond the contractor's control.

The Wisconsin department of natural resources (DNR) must receive a copy of the ECIP developed by the contractor 14 days before the preconstruction conference. The DNR should be consulted on the erosion control needs and the measures proposed to be taken.

*Requirements for preparation and submittal of the Erosion Control Implementation Plan (ECIP) as prescribed in CMM 6-45.2 are mobilized into the contract by standard spec 107.20.*

### 6-45.2 Erosion Control Implementation Plan (ECIP)

Standard spec 107.20 and Chapter TRANS 401.08 Wisconsin Administrative Code require the prime contractor to prepare and submit an ECIP for a project. The prime contractor must submit the ECIP to the appropriate region office of the department and to the region liaison at the appropriate region office of the DNR. The ECIP must be submitted at least 14 days before the preconstruction conference, or at a time otherwise agreed upon by the DOT, DNR and prime contractor. It is to contain project implementation details that indicate the timing of project activities related to erosion control, such as staging and the placement of erosion control practices.

An ECIP is required for any WisDOT-administered project that contains an erosion control bid item or a structure removal over a waterway special provision. However, the details and contents of the ECIP depend on the project type. WisDOT- administered projects that do not contain erosion control bid items do not require the submittal of an ECIP, unless specified otherwise by the department. The ECIP may be completed in stages, if approved by the department. For example, if borrow and material disposal sites are not known at the time of the ECIP submittal, a staged ECIP will likely be approved. The initial ECIP for the project should indicate that other

stages would be submitted later. The engineer must consult with DNR before approving staged ECIP submittals.

The region reviews the ECIP for conformity with TRANS 401 requirements. The DNR also reviews the ECIP and sends comments to the region before the date scheduled for the preconstruction conference. If the DNR has not sent comments by that date, assume that the DNR concurs and construction can proceed. The ECIP must receive region approval before the contractor can start construction. Keep a copy of the approved ECIP in the field office. The engineer must monitor compliance with the approved ECIP during construction.

The contractor should consider the erosive effects of its planned operations and provide an ECIP that will mitigate and control erosive action. Permanent erosion control required in the contract plans can be used as a guide and basis in planning complementary interim erosion control measures. Measures necessary to control erosion based on the contractor's particular schedule or sequence of operations should be addressed. Items that should be provided for in the ECIP include but are not limited to the following:

1. Provide a schedule of grading operations showing the grading segments and sequences necessary to conform to or satisfy the intent of the number of erosion control mobilizations provided in the contract plans. A variation in the number of mobilizations can be submitted for the engineer's approval.
2. Show on the erosion control or plan and profile sheets the specific erosion control measures that must be in place before grading operations begin, if they are not indicated in the contract.
3. Show interim treatment between sequences or operation, noting specific erosion control device type and location using plan sheets. In particular, address protection for sensitive areas, including streams, lakes, uplands, and woodlands. Include provisions for topsoil storage locations and dewatering sites when applicable. Address stream diversion methods in detail.
4. For borrow and material disposal sites (selected sites), provide a complete erosion control plan and an ECIP, including the appropriate calculations to demonstrate that the proper erosion control measures are being used.
5. Designate the person on the contractor's staff responsible for erosion control administration, and include mobile telephone numbers. Responsibilities include consideration and mitigation of soil erosion in planning grading activities, mobilization of materials and work force to meet erosion control needs, monitoring of the project site for necessary revisions to the erosion control effort, and monitoring and maintenance of the in-place erosion control devices.
6. Hydrologic and hydraulic calculations for selected sites that would be severely impacted by off-site erosion because of the proposed excavation as fill.
7. Give details of either a structure removal plan or a structure removal and clean-up plan depending on the environmental sensitivity of the affected waterway and the feasibility of various strategies the contractor might employ to protect the waterway.

Other items to be considered in the plan may include:

1. Access to site (causeway, temporary roads)
2. Topsoil (removal, storage, and placement)
3. Special ditches and intercepting embankments
4. Embankment (cuts and fills)
5. New structures over waterways (abutment fills, excavation, temporary crossings)

In development of the plan and during prosecution of the erosion control measures, the contractor should:

1. Use innovative ideas and techniques. Be specific in schedule and detail.
2. Maintain flexibility. Be ready for adjustments and alterations.
3. Rethink past practices.
4. Have necessary materials on the job site for timely installation. Preplan implementation of erosion control measures.
5. Be prepared to correct, augment or add measures during and after periods of runoff.
6. Revise ECIP should planned operations significantly change.

During review of the plan and during the work operations, the engineer or responsible WisDOT agent should:

1. Thoroughly review the plan, analyze measures in detail for shortcomings, and discuss details.
2. Be generous in application without extravagance.
3. Adjust methods and limits as needed.
4. Maintain continuing inspection and surveillance to assure adequacy and performance. Suggest corrective measures where and when needed. Inspections are required weekly, after each 0.5-inch rainfall, at the beginning

and ending of each stage, and at the completion of the project. The inspector must use department form WS1072, Erosion Control Diary. The inspection documentation should be maintained in project files with the approved ECIP.

5. Require amendments to the ECIP from the contractor when construction practices no longer conform to those described in the ECIP.
6. Review and approve the ECIP amendments.
7. Inform DNR of significant changes to the initial ECIP.

Adjustments and alterations may be necessary after plan review and during construction. The contract should provide quantities for the common erosion control items encountered on a project. A list of approved erosion mats is available in the department product acceptability lists (PAL).

http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/tools/pal/default.aspx

The approved mats are designed for specific applications and should be used accordingly. Follow the procedures of the WisDOT FDM Chapter 10 for the proper design of erosion mat application. It is helpful to discuss changes with the design engineer for their input on the original design intent.

For the detailed ECIP requirements refer to TRANS 401.08 Wisconsin Administrative Code. Copies of Chapter TRANS 401 Wisconsin Administrative Code are available for reviewing at transportation region offices. As part of the awarded contract package the department provides the prime contractor department form WS1073 "Erosion Control Implementation Plan Worksheet,". It is available at:

http://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrces/environment/ws1073.doc

The worksheet also describes what is required for selected (borrow and material disposal) sites. The contractor must fill out Section B – Erosion Control Implementation Plan – Selected Sites for each selected site for the project.

### 6-45.3 Measures Taken During Construction

The planned location of erosion installations should be reviewed and the final location adjusted to fit field conditions. Substitution of materials may be necessary. As an example, sodding may not always be adequate to prevent erosion and formation of gullies on areas subject to concentrated flow of water at a relatively high velocity, and in such cases erosion control may require the use of pipe down drains, riprap, or other appropriate means.

Sound erosion control practices include reasonable restrictions on grading; maintaining drainage and consolidating and trimming the subgrade daily to aid drainage and protect against erosion; vehicle access and parking; materials delivery and storage sites; constructing and maintaining temporary silt fences; stabilizing bare soil as soon as possible by seeding, sodding, mulching, using soil stabilizer or erosion mats; and installing plant materials at the earliest opportunity. The best way to ensure the success of these endeavors is through engineer-contractor cooperation during the entire life of the contract. It is essential that along with the requirements the contractor must strive to maintain an erosion-free project. WisDOT provides the assurance the contractor will be paid for the restoration of damaged areas to the extent previously mentioned in background above.

The contractor is expected to ensure the work does not encroach on or directly affect wetlands, streams, or other waters of the state abutting highway right of way. The engineer should be alert to such situations, and if they occur, order the contractor to cease the work operation, remove all encroachments, and restore the area to its prior condition as nearly as practicable. No work shall be performed in waters of the state without prior concurrence of DNR and the U.S. Army Corps of Engineers, except in an emergency.

Temporary and permanent erosion control measures specified in the contract should be installed in a timely fashion. The engineer should be alert for situations requiring further erosion control measures not foreseen in the plan and schedule, and order the proper erosion control devices to be installed where needed to prevent degradation of the highway and surrounding lands.

The best solution to erosion-related damage is anticipating or identifying possible problems and taking preventive measures. Early erosion control practices are far less expensive than damage repair when all impacts are considered. Timely installation is essential. The prime contractor or the subcontractor charged with erosion control must take all necessary steps to install the erosion control measures at or before the time they are needed. Being busy on another project or another work operation is not an acceptable reason for late installation or no installation. A wide range of relatively simple practices is available. Early protective measures can include detention basins to trap runoff and sediments, proper procedures and locations for removing and storing topsoil, and measures to protect nearby lakes, streams, and woodlands. Other acceptable, proven measures are intercepting embankments, berms, dikes, dams, settling basins, ditch checks, riprap, mulches,

erosion mats, silt fences, seeding, sodding, plantings, and special control installation as called for on the plans or ordered by the engineer.

Erosion control items that have proven effective when correctly installed at suitable sites include:

1. Rock check-dams, clean concrete ditch checks, and mortar rubble masonry ditch checks in ditches with step slopes
2. Rock lining of ditches, with a geotextile underlayer
3. Riprap in ditches at the toe of new slopes and along shorelines

Temporary erosion control measures should be coordinated with the permanent measures to secure continuous erosion control as economically as possible. However, temporary measures are not to be constructed in lieu of permanent measures specified in the contract, since it is the permanent measures that provide the ultimate control.

Permanent and temporary erosion control items that are damaged or lost, or found to be defective should be replaced as soon as possible. Replacement necessitated by damage or loss resulting from conditions beyond the contractor's control will be paid for under the standard bid item. Defective materials or installation must be replaced at the expense of the contractor.

Standard spec 107.20 limits the amount of erosive land that can be opened up. The area is not defined in square yards but rather is the area that the engineer can approve based on specific conditions affecting the area. Contractors must pursue operations in a timely and diligent manner, continuing all construction operations methodically, expeditiously, and with adequate forces from the initial topsoil stripping operation through subsequent grading operations and ultimate re-topsoiling, seeding, and other associated landscaping operations. Standard spec 107.20 extends full authority to the engineer to suspend or limit the contractor's grading operations should the contractor fall behind on erosion control work.

Occasionally, job conditions may require disturbance of the ground surface beyond the right of way line, such as might occur from the storage of topsoil or from grubbing or finishing of the adjacent slopes, especially where right of way widths are restricted. Fertilizing, seeding, and mulching of such areas will be measured and paid for under the appropriate item, provided such areas are contiguous to the right of way, of a reasonable size, and justified by the job conditions.

The basic work items involved in erosion control are topsoiling, fertilizing, seeding, ditch checks, sodding, mulching, erosion mats, sedimentation basins, and silt fence.

### 6-45.3.1 Erosion Control Order Form

The engineer is responsible for inspections on WisDOT administered projects, as detailed under TRANS 401, to ensure project compliance with the ECIP. If corrective action of erosion control items is identified, written notification must be given to the contractor on department form WS1074, Erosion Control Order. This would be for the following cases:

1. When an Erosion Control Corrective Action is required. The contractor must mobilize within 24 hrs of receiving the order. Corrective action is limited to situations where:
   A. The order is to perform corrective action, such as correcting items not properly installed, installing items not installed as previously ordered, or repairing damaged items
   B. The work is required because the contractor is out of compliance with the project erosion control plan or ECIP per Trans 401.
   C. The work is part of normal maintenance covered and paid under a previously installed bid item.
2. When an Erosion Control Mobilization is required (see CMM 6-45.4). The contractor must mobilize within 72 hrs of receiving the order.
3. When an Emergency Erosion Control Mobilization is required (see CMM 6-45.5). The contractor must mobilize within 8 hours of receiving the order.

## 6-45.4 Mobilization of Erosion Control

The bid item of Mobilizations, Erosion Control has been established for the purpose of providing payment to the contractor for efforts required to marshal labor, equipment, and materials to complete seeding, mulching, sodding, and other erosion control measures at planned increments or stages during the life of the project. It is intended for use in situations where erosion control mobilization is required per the ECIP or ECIP amendments. The contractor is required to mobilize within 72 hours unless otherwise agreed to in writing by the project manager, such as for planned future work or work that carries little environmental risk. Payment under this bid

item will be made for erosion control activity only if all of the following conditions are met:

1. The erosion control has been preplanned.
    A. In the original contract plan, or
    B. In the approved contractor's ECIP, modifying the contract plan, or
    C. Ordered in writing by the engineer subsequent to (A) or (B) to respond to changed site conditions or unusually severe weather, but not requiring emergency response of eight hours.
2. The erosion control requires a substantial move-in of personnel, equipment, and materials. Use of on-site personnel, equipment, and materials is minimal to none.
3. The erosion control does not constitute normal maintenance of erosion control item installations.
4. The erosion control does not constitute incomplete installation of erosion control items covered by a previous mobilization or planned stages, unless required by changed site conditions or unusually severe weather and approved by the engineer.

Amendments to the ECIP not necessitated by the contractor being out of compliance with Trans 401, or associated with contractor-selected waste or borrow sites, which result in the landscaper needing to mobilize to the project with additional equipment or manpower, will result in one additional mobilization granted per ECIP amendment.

Thus, the contractor and the engineer must plan ahead to ensure that all erosion control measures are performed for a completed stage and are provided as required for a following stage. This requires an ongoing evaluation of both the permanent and temporary measures required as work progresses. Attention by the engineer, prime contractor, and appropriate subcontractors will minimize the potential for "call back" and its inherent costs.

Refer to standard spec 628.5.11, Mobilizations Erosion Control, for payment information and for the deduction to be assessed for failure by the contractor to mobilize in a timely manner, following written order by the engineer.

### 6-45.5 Emergency Mobilization of Erosion Control

The Mobilizations Emergency Erosion Control bid item has been established to provide payment to the contractor for efforts required to marshal labor, equipment, and materials to complete seeding, mulching, sodding, and other erosion control measures that may be required for emergency situations during the life of the project. It is intended for use in emergency situations where erosion control mobilization is required within eight hours. Orders issued under this bid item will be made for emergency erosion control activity only if all of the following conditions are met:

1. The erosion control has not been preplanned, such as mobilization included in the ECIP.
2. The erosion control has been ordered in writing by the engineer.
3. The erosion control requires a substantial move-in of personnel, equipment and materials beyond those already available on-site.
4. The erosion control does not constitute interim installation of erosion control items between planned stages, unless required by changed site conditions or unusually severe weather and has been approved by the engineer.
5. The erosion control work is deemed urgent and necessary to minimize risk of offsite sediment discharges. The risk of release may be due to forecasted weather conditions, flooding, change in site conditions (such as discovered a spring or breach in adjacent construction), etc.
6. The required work cannot be installed within 72 hours requirement of "Mobilizations of Erosion Control" without substantial environmental risk.

Refer to standard spec 628.5.12, Mobilizations Emergency Erosion Control for payment information and for the deduction to be assessed for failure by the contractor to mobilize in a timely manner, following written order by the engineer.

### 6-45.6 Structure Removals Over Waterways

#### 6-45.6.1 Background

Structure removals over waterways require special attention. These removals are covered by special provision. One of three special provisions will be applicable for each structure removal in the contract. Each special provision lists the structure number or a brief description of each applicable structure. All of the special provisions require additional information that the contractor must include in the ECIP.

The removal specials define three levels of care that the contractor must take depending on the sensitivity of the waterway and characteristics of the structure to be removed. The baseline level of care requires the contractor to minimize debris falling into the waterway. The highest level of care requires a debris capture system to prevent virtually all debris from falling into the waterway. The lowest level of care is for situations where there is little choice but to drop the structure into the waterway.

Designers consult with DNR and industry representatives to make sure each structure is included under the appropriate special provision. The contractor must describe the precautions they will take to prevent or minimize impacts to the waterway. The department must give written approval of the contractor's removal and clean-up plans before work covered under that plan begins.

### 6-45.6.2 Reviewing the Structure Removal and Clean-up Plans

Department staff should make sure that the contractor's required removal and clean-up plans are appropriate for the level of care required in the special provisions. The following are strategies or techniques that the contractor might employ. This is by no means an exhaustive list of appropriate measures, nor is it a set of minimum requirements. The contractor is encouraged to develop new and innovative approaches to protect the waterway during removal operations. This toolbox is provided to help the contractor put together an effective plan that can be customized to the individual project as well as the contractor's available resources. Likewise the toolbox should help department evaluate the contractor's plan.

- Provide decking attached to the structure.
- Provide barges beneath the structure.
- Build false decks or other temporary structures.
- Provide a crane suspended platform beneath the removal area.
- Provide blasting mats for abutments.
- Provide fencing in the waterway to prevent material from washing downstream.
- Wet-saw the structure into large, manageable sized pieces.
- Use "slab grab" equipment to remove large pieces.
- Provide fencing or side panels on debris collection devices.
- Use fabric or fencing material slung under demolition areas.
- Choose equipment that will minimize the creation of dust and small debris.
- Remove saw slurry, chips, and other potential small debris at the end of each work-day.
- Use vacuum equipment during demolition operations.
- Load and haul away debris immediately as it is created.
- Build temporary work roads.
- Cover accumulated on-site debris to assure containment during windy or rainy conditions.
- Provide boomed equipment with grabber attachments to remove debris from the waterway.
- Remove debris from the waterway by hand.

### 6-45.6.3 Example Removal and Clean-up Plans

**Removing Old Structure Over Waterway: Item 203.0500.S**

*Structure B-XX-XX will be removed in the following manner.*

1) *A crane mounted wrecking ball will be used to break apart the existing structure.*
2) *All rebar will be removed from the waterway.*
3) *All large pieces of concrete will be removed from the waterway using a clam bucket.*
4) *The existing waterway bottom will be restored to approximately original depth. The smaller pieces of concrete remaining will be used to repair the streambed according to the plan. This work will be done by hand.*

***Alternate Removing Old Structure Over Waterway***

***Item 203.0500.S***

1) *The existing concrete deck will be saw cut into 7'x10' slabs and then removed by a crawler crane.*
2) *Once the slabs are removed the truss will be lightened to a point at which it can be tipped into the stream and then removed in as large sections as the crane can handle.*
3) *The existing pier will be removed by use of a hydraulic breaker to a point 2 feet below*

*existing ground.*

4) *The existing abutments will be excavated to the landward side and removed in that direction by a hydraulic breaker.*
5) *All reinforcing steel and concrete rubble greater than 5" diameter will be removed from the river by use of a clam bucket then trucked off the project site.*

**Removing Old Structure Over Waterway With Minimal Debris: Item 203.0600.S**

*Structure B-XX-XX will be removed in the following manner.*

1) *A longitudinal saw cut will be made on the "limits of removal" line between Stage I and Stage II. The median side of the bridge deck will be removed in Stage I. Traffic will be operating on the right side of the bridge.*
2) *Transverse saw cuts will extend between the longitudinal saw cut and the curb line.*
3) *A Backhoe mounted breaker will be used to break vertical slot through the parapet and curb parapet at these locations to minimize pieces of broken concrete during removal.*
4) *A backhoe with a "slab grab" attachment will be used to remove and carry the large precut sections of concrete deck to the end of the bridge.*
5) *Removing the bridge deck in large sections in this manner will significantly reduce the amount of small pieces that fall to the ground. Any large pieces of concrete in dimension, all reinforcing steel, and other debris that fall in the water will be picked up using a bucket clam and disposed of at the XYZ quarry.*
6) *Removal operations at the abutments will be completed by excavating behind the abutment and then removing in that direction.*

*Bridge Pier Removal*

1) *Turbidity barrier or sheet piling will be installed around piers as defined in the contract.*
2) *The bridge piers will be removed using a wrecking ball.*
3) *Any large pieces of concrete in dimension, all reinforcing steel, and other debris that fall in the water will be picked up using a crane and clam bucket.*

*Alternate Bridge Pier Removal Plan:*

1) *Sheet piling will be installed around the piers.*
2) *Water will be pumped to a settling basin at the location indicated on attachment B.*
3) *A hole will be drilled in the old footing to house a localized charge, the charge will be localized enough to prevent widespread projectile debris.*
4) *The debris from the blast will be removed with a clam bucket.*
5) *Sheet piling will be removed after the new piers are poured.*

**Removing Old Structure Over Waterway With Debris Capture System: Item 203.0700.S**

*Structure B-XX-XX will be removed in the following manner.*

1) *A backhoe mounted hydraulic breaker will be used to cut the concrete deck into approximately 6 foot x 15 foot sections.*
2) *A backhoe will be used to remove the deck sections.*
3) *For areas of the deck that are over water, a barge will be floated under to catch all debris, or if a barge is not possible, plywood decking will be placed between the existing bridge beams under the areas where the cuts are to be made.*
4) *As the cuts are made to divide the deck into sections, concrete chips will be caught on the barge or the plywood decking.*
5) *After the deck sections are removed, the concrete chips will be removed and taken to the*

*disposal area.*

6) *The girders will then be removed using a crane.*
7) *The bridge abutments will be removed by excavation behind and then removing in that direction.*
8) *The concrete debris from the removal operations will be disposed of in the fill areas of the new roadway as directed by the engineer.*
9) *A flocculent approved by DNR for use in the water and silt screen will be on-site for use incase of a failure to the system.*

#### 6-45.6.4 Monitoring Compliance

One of the goals in developing these special provisions is to improve the department's ability to administer this work and determine if the contractor is removing the structure according to the contract. The basic strategy of these specials is:

- The contractor develops a removal plan meeting the requirements of the special provision.
- The department and DNR approve the contractor's removal plan.
- The department uses the approved removal plan as the key focus for contract administration. The department determines contract compliance by holding the contractor accountable to diligently follow the prevention, mitigation, and clean-up measures they identified in the approved plan.

The special provision language describes requirements for "large" or "small" pieces of debris and "limited amounts" without giving measurable definitions for those terms. The language is vague in part because of past abuses based on language that required removal of all pieces larger than 5 inches in any dimension. The language is also vague to allow some flexibility in the field. Department staff should coordinate with the contractor to make sure that both parties understand how these terms will be interpreted under the contract. The department's environmental coordinators, erosion control specialists, or DNR liaisons can help field staff determine what might be appropriate for their specific set of circumstances. Often times operations required to remove debris from the waterway can cause more damage than leaving it in place.

### 6-45.7 Erosion Control Items

#### 6-45.7.1 Erosion Mat

Erosion mat is placed on seeded areas of the graded roadway to prevent erosion while turf is forming. It is important that the mat be placed immediately following completion of the seeding and before a rain occurs.

All erosion mat products must be pre-qualified by the department before use. Erosion mat products must be selected from the erosion control Product Acceptability List (PAL) developed and maintained by the department. The PAL identifies pre-qualified erosion mat products by class and type. A copy of the PAL may be obtained at

http://www.atwoodsystems.com/materials

The specifications for the different classes of erosion mats, and for the biodegradable anchoring devices to be used with Class I Type urban mats, are contained within the PAL.

The required class and type of erosion mat will be shown on the plan or will be specified by the engineer. The contractor may furnish any pre-qualified erosion mat product of the class and type shown on the plans or specified by the engineer.

Substitutions within class should not be made without verification being made with the designer. For example some of these mats are commonly requested by the DNR liaison or may be needed to meet a certain shear stress requirement. Under no circumstances should products not specifically listed on the PAL be accepted.

Before installation, the contractor must provide the engineer with one full set of the manufacturer’s literature and the recommended installation procedure for each selected product. Installation must be in accordance with the procedure recommended by the manufacturer unless otherwise specified in the contract or directed by the engineer.

Class III Type B, Type C, and Type D erosion mats must be covered by a soil stabilizer or erosion control revegetative mat as required by standard spec 628.2.1. When a soil stabilizer is used, application must be at the rate recommended by the manufacturer of the soil stabilizer, unless otherwise specified by the engineer or special provisions.

The inspector is responsible for determining that the area to be covered is in a suitable condition. The surface of the seeded area should be reasonably even, and all stones, clods, sticks, or other objects that would interfere with the mat laying completely on the soil should be removed. The inspector should ensure that the following procedures are followed:

- The mat is placed in a natural smooth position without stretching.
- The mat is completely on the soil.
- Proper overlaps are made.
- Installation of anchor and check slots, when required, are properly made.
- The mat is correctly anchored in place.

Erosion mat placed in channels (ditches) should be placed at a width that will ensure that the outer ends are approximately one foot higher than the elevation of the channel bottom.

Areas of seeding disturbed in making the anchor and check slots should have more seed scattered on them. After the fabric is in place, water must be sprayed on the area to moisten the seedbed to a depth of 2" to expedite germination.

Erosion mat designed for lesser flows is typically placed in the upper reaches of a ditch or waterway. Subsequent sections through the middle and lower reaches will require mat designed for greater flows, or perhaps sod or reinforced sod, dependent upon conditions of runoff.

### 6-45.7.2 Erosion Bales

Erosion bales consist of straw, hay, or other suitable material of the size shown on the plan placed as dikes or dams to control runoff from ditches or slopes. These bales are effective in controlling the deposition of sediments on adjacent properties, as well as reducing the formation of rivulets and gullies, when placed and staked in accordance with plan details.

Erosion bales should be placed across the full ditch bottom and up the ditch sides to allow water to flow over the center bale. This will prevent flow around the ends of the bales. Refer to SDD 8E8.

The locations shown on the plan for installation should be considered a guide. Additional bales should be placed when and where warranted by field conditions. Also, the locations shown on the plans may require adjustment to fit field conditions. After several rains, the bales may be filled with sediment and no longer will allow water to pass. They should be replaced when effectiveness is lost. Generally, they are to be removed by the contractor after slopes are established and turf has developed, unless the engineer determines leaving them in place to rot would be beneficial.

### 6-45.7.3 Sedimentation Basins

Sedimentation basins are artificial collection ponds excavated to contain and control sediment-laden surface runoff. The basin should be of a size sufficient to retain the inflow for the required number of hours or days. The resultant clear water then seeps into the ground, evaporates, or is released via a spillway or overflow pipe, leaving sediment as a precipitate on the bottom of the basin. Direct flow-through of the basin should not be permitted.

Sedimentation basins must be inspected regularly, cleaned out as needed, and maintained in accordance with plan details if they are to be effective. Ultimate disposition of the sedimentation basins must be as shown on the plans or special provisions.

### 6-45.7.4 Silt Fence

Silt fences are erected to trap sediment-laden surface water flowing off a slope in a sheet flow or along a shallow, low-velocity, low-flow ditch. They are constructed by stretching a geotextile fabric between vertical posts, attaching it to the posts and to support wires strung between the posts, and trenching in the foot of the fabric. The fabric allows clear water to eventually pass through while leaving the sediment as a precipitate up slope from the fabric. Construction should be in accordance with the plan details, including post diameter, length and embedment, fence height, fabric type, fabric overlap, wire gage, and depth of trench. Refer to SDD 8E9 for installation details.

Do not place silt fence across channels unless it is heavily reinforced. Acceptable reinforcement would be the use of steel fence posts with a steel mesh or woven wire fence used behind (downstream of) the silt fence fabric.

Silt fence installations will need to be inspected regularly, cleaned out as needed, and maintained. Additional bracing or guying may be needed to provide full support of the fabric under heavy water flows.

Silt fence should be removed after slopes and turf are established. This may require allowing the silt fence to remain until the next year or at least for several weeks. If the contract has not been closed at the time of removal, the contractor is required to perform the removal and disposal. If the contract is closed, the maintenance forces of the authority controlling the highway must do the removal and disposal.

### 6-45.7.5 Silt Screen

Silt screen is a floating geotextile material used to minimize sediment transport within a body of water. Unlike turbidity barriers they do not touch the bottom of the watercourse. Instead they float from the surface of the water to approximately two feet above the waterbed.

Silt screen works by deflecting sediment that then settles out and deposits at the bottom of the screen. It is important that silt screen not touch the bottom of the waterbed, as sediment build up could then “sink” the floats allowing sediment-laden water to enter the waterway.

Silt Screens generally work best where the sediment particle size is larger or where water flow prevents the use of a turbidity barrier. Selection is normally based on coordination with the DNR/DOT liaison.

Consideration should also be given to standard spec 107.19, Construction Over or Adjacent to Navigable Waters. The designer must have established, and noted in the special provisions, if the waterway is so designated.

### 6-45.7.6 Turbidity Barrier

Turbidity barriers are fence-like structures and are placed within a body of water to barricade sediment from being transported. A geotextile material is stretched on posts from the bottom of the waterbed to an elevation two feet above the anticipated high water mark for the time of the year the barrier is to be placed.

Turbidity barrier works by totally enclosing a work area and separating it from a body of clean water. It is not intended as a device where de-watering may be done behind it, such as with sheet piling, nor is it intended to be used where currents exceed 5 feet/second. If currents exceed these limits, other measures should be considered to divert water away from the area being worked on or disturbed. This may be accomplished by using other devices such as sheet piling, cofferdams, or just reinforcing the turbidity barrier.

In moving water conditions, provisions must be made to allow the volume of water contained within the barrier to change. Since the bottom of the barrier is weighted, the volume of water contained within the curtain will be much greater at high water levels. Therefore, measures need to be taken to prevent the barrier from collapsing and to allow water to be equalized on each side of the barrier. This may be achieved by constructing part of the curtain from a heavy filter fabric. The fabric allows the water to pass through the barrier yet retain the sediment. Consideration should be given to the volume of water that must pass through the fabric and sediment particle size when specifying fabric permeability.

Barriers are one of the last lines of defense, and should be used as part of an overall erosion and sediment control plan. Other on-land measures should be utilized to minimize sediment in the turbidity barrier enclosed area.

Turbidity barriers generally work best in locations having finer particle sizes. Selection is normally based on coordination with the DNR/DOT liaison.

Consideration should also be given to standard spec 107.19, Construction Over or Adjacent to Navigable Waters. The designer must have established, and noted in the special provisions, if the water way is so designated.

The bid item provides for payment of turbidity barrier by the square yard. It is WisDOT’s intent to pay for whatever height of barrier is needed to meet the two-foot requirement above the anticipated high water mark for the time of year the barrier is to be placed. This requires the contractor to adjust the height based on anticipated seasonal flows. Work being done in the early spring would normally require a higher barrier than work being done in midsummer.

Another consideration would be how long the barrier is to remain in place, or in other words what is the chance of a peak event during the time it is to be in place. High water elevations indicated on plans, contacts with local officials, contracts with area residents, and discussions with region maintenance representatives are all sources of information for obtaining this data. Barriers that are placed unreasonably high for the time of year that the work is to be done, only create an eyesore and have been criticized by the public.

Consideration should be given to the placement of riprap or other permanent erosion control measures as soon as possible in order to minimize the duration that the barrier is in place.

Care should be taken when removing the barrier due to the possible release of sediment. When possible, the barrier should be released when the flow rates are low. Consultation with the DNR/DOT liaison is recommended.

### 6-45.7.7 Riprap

#### 6-45.7.7.1 Compliance with the Specification

There are several problems that the DOT typically has with riprap – stone sizes may be too small, stone size

may be poorly distributed, or too many fines may be included. The riprap specification describes riprap dimensionally so that the engineer can, in the field, measure the supplied stone for the project to determine whether it meets the specification. The spec requires engineers to determine the average dimensional range for the stone and the required fraction of gross in-place volume occupied by the riprap.

To determine if the supplied stone meets the larger dimension ranges for a project, first mark out a 20 square feet area of in-place riprap with paint. Measure the largest stones in the 20 square foot area, marking and numbering each stone as it is measured. Measure each stone in three perpendicular dimensions and calculate the average of these measurements to get the average dimension. If there are few or no stones that fall within the two highest dimension ranges, then the supplied stone does not meet the specification.

Another way to determine if the stone is within specification is to count the number of stones that fall within the size gradations for a type of riprap. Table 1 below describes number of stones required within each average dimension size range for each 10 cubic yards of in-place riprap. This method is labor-intensive and requires either lifting heavy stones or counting large numbers of stones.

**Table 1 Riprap Gradation Averages**

| | Average Dimension (inches) | Number of stones per 10 cu. yd. of riprap |
|---|---|---|
| Light Riprap | >16 | 0 |
| | 11 – 13 | 35 – 48 |
| | 9-11 | 92 – 130 |
| | 4-9 | 445 – 620 |
| | <4 | 1850 – 2700 |
| Medium Riprap | >20 | 0 |
| | 14-16 | 10 – 27 |
| | 11-14 | 45 – 65 |
| | 5-11 | 240 – 340 |
| | <5 | 1080 –1620 |
| Heavy Riprap | >25 | 0 |
| | 18-20 | 9 – 13 |
| | 14-18 | 22 – 32 |
| | 6.5-14 | 112 –160 |
| | <6.5 | 580 – 810 |
| Extra Heavy Riprap | >30 | 0 |
| | 22-25 | 5 – 7 |
| | 18-22 | 12 – 16 |
| | 8-18 | 56 – 78 |
| | <8 | 240 – 345 |

### 6-45.7.7.2 Conversion to Weight

If you need to convert in-place riprap volume to total riprap weight, multiply the in-place volume in $ft^3$ by (1 - 0.40), where 0.40 is the assumed void ratio of the riprap, and then multiply the resulting number by the specific weight of water (62.4 lbs/ $ft^3$) and by the specific gravity of the stone (SG=2.65). To convert an individual stone from stone volume to stone weight, multiply the stone volume ($ft^3$) by the specific weight of water (62.4 lbs/$ft^3$) and by the specific gravity of the stone (SG=2.65).

### 6-45.7.7.3 Fine Particles in Riprap

The requirement that no more than 2% of the in-place riprap be less than 1 inch in size was included to prevent the contractor from placing large amount of fines with the riprap. From a volumetric point of view, this requirement translates into a maximum allowable thickness of fines in the riprap, as described in the table below. The acceptable thickness is calculated by multiplying the minimum depth of the riprap volume, as described in the specification, by 2%.

Since the riprap specification is an in-place spec, and since riprap is usually placed on top of geotextile fabric Type R or HR, measure the depth of the fine material on the riprap apron in six random locations on a 20 $ft^2$ area, taking care to include both the bottom and sides of a channel. If the average depth of the sediment

significantly exceeds the acceptable average thickness listed in Table 2 below, then the riprap supplied by the contractor does not meet the DOT's specification.

However, in applying this method, good judgment should be used. It should be kept in mind that fines may collect on the fabric in the spaces between the riprap stones. This could give the appearance of more fines than are actually present. This procedure should be done before it rains, because sediment transport from a rainfall will alter the quantity of fines in the riprap. Observing the amount of soil attached to the stones at time of delivery would provide a means to judge if excessive fines may be a problem.

**Table 2 Acceptable Thickness of Fines for Riprap**

| Riprap Gradation | Minimum Riprap Thickness (inches) | Acceptable Average Thickness of Fines Covering Geotextile Fabric Type R or HR (inches) |
|---|---|---|
| Light Riprap | 12 | 1/4 |
| Medium Riprap | 18 | 3/8 |
| Heavy Riprap | 24 | 1/2 |
| Extra-Heavy Riprap | 30 | 2/3 |

### 6-45.7.8 Tracking Pads

#### 6-45.7.8.1 General

The best approach to preventing off-site tracking is to restrict vehicles to stabilized areas. It is always preferable to prevent sediment from being deposited upon the road than cleaning the road later. Sediment on a road can create a safety hazard as well as a pollution problem. Any sediment tracked onto a public or private road should be removed by street cleaning or sweeping, not flushing, or as directed by the engineer.

Tracking pads reduce off-site sedimentation by eliminating the tracking of sediment from construction sites. The contractor must install a tracking pad wherever traffic will leave a construction site. This practice applies where construction traffic is likely to transport sediment off site onto private or public roadways.

Stone tracking pads remove sediment from the tires of vehicles by allowing the tires to sink into the stone base slightly. This action, combined with the rolling motion of the tires, acts to knock loose the majority of sediment from a vehicle's tires before it leaves the site. Manufactured tracking pads should produce similar results.

#### 6-45.7.8.2 Construction

The tracking pad must be installed before any traffic leaves the site. The aggregate must meet the gradation requirements of select crushed material per standard spec 312.2, with the exception that material passing the No. 10 sieve should be negligible by visual inspection. The aggregate layer must be constructed to a minimum depth of 18 inches.

Stone tracking pads must be underlain with a Type R geotextile fabric to prevent migration of underlying soil into the stone. The tracking pad must be the full width of the egress point or 12 foot minimum. The tracking pad must be at a minimum 50 feet long. Surface water must be prevented from passing through the tracking pad. Flows must be diverted away from tracking pads or conveyed under or around them by using culverts, trenches, or diversion dikes that divert surface water runoff into a dispersion area, or other similar practices. There is no additional compensation for practices used to divert water.

#### 6-45.7.8.3 Proper Use and Maintenance

Tracking pads only perform when maintained properly. Vehicles traveling across the tracking pad should maintain a slow constant speed. Rocks lodged between the tires of dual wheel vehicles must be removed before the vehicle leaves the construction site.

Maintenance is needed when existing stone becomes buried in sediment or tracking onto roadways creates a safety issue. The tracking pad performance must be maintained by scraping or top-dressing with additional aggregate. A minimum 18-inch thick pad must be maintained.

#### 6-45.7.8.4 Removal

Once the project site has been stabilized and the tracking pad is no longer needed, the materials must be removed and the area restored.

#### 6-45.7.8.5 Alternatives

Alternative methods, i.e. manufactured products, wash racks, or tire washing stations may be used. If proposing an alternative method, the contractor must provide, at a minimum, the following in the ECIP:

1. Schedule for installation and removal
2. Standard drawings and installation details
3. Stabilization after removal