Conventional and Soil Riprap Construction Guidance Checklist

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Scan the code for our Construction Management playlist on YouTube

Conventional/Soil Riprap Introduction

Riprap is larger angular rock that is typically used for erosion protection along drainageways, streambanks, and shorelines. There are 3 types of riprap used in District projects:

- Plain or "Conventional" Riprap
- Soil Riprap
- Void-Filled Riprap

Conventional Riprap Introduction

Conventional Riprap:

Conventional riprap is plain angular rock that has been used extensively through the District's history. In recent years, the District's preference is to use conventional riprap only where vegetation is not anticipated like around abutments and piers under bridges and small installations like pipe outfalls.

Soil Riprap Introduction

Soil Riprap:

Soil riprap refers to riprap that has all the voids filled with native soil or topsoil. Soil riprap is commonly used where vegetation is anticipated and can be buried with an additional layer of topsoil, providing a good growing medium for vegetation. Soil riprap is typically used for erosion protection along stream banks, pipe outfalls, buried rock swales, and buried emergency spillways for detention basins and ponds.

Riprap Materials

STEP 1 (Materials):

- Riprap should be crushed, angular granite.
- Verify that riprap meets requirements for color, size and gradation. Confirm size and gradations by checking delivery tickets and measure dimensions of the rock using a tape measure.
- Due to quarry availability and material variability, it may be necessary to adjust the size. Get approval from the Engineer before making any material adjustments.

The District has 5 different riprap sizes or gradations:

- Type VL (D50 6”)
- Type L (D50 9”)
- Type M (D50 12”)
- Type H (D50 18”)
- Type VH (D50 24”)

Type VH Riprap (D50 = 24-inches)

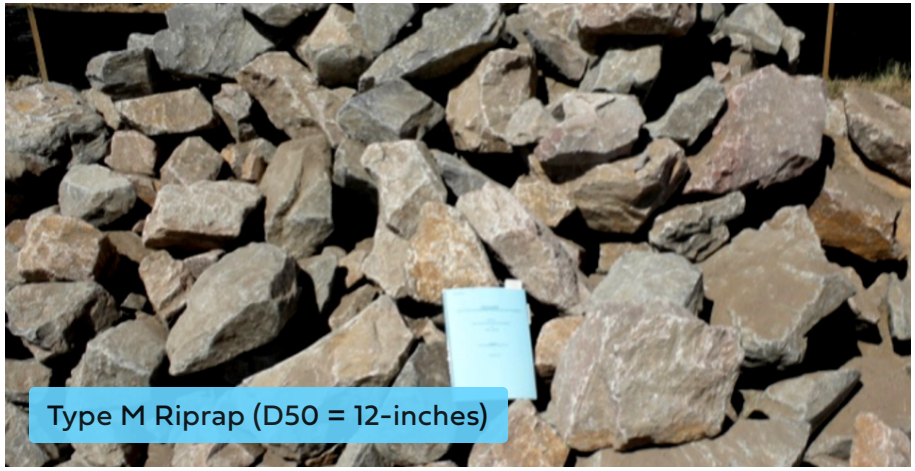
Riprap Materials

Sizes/Gradations:

Four of the standard riprap gradations in the District.


Type VL Riprap (D50=6-inches)


Type L Riprap (D50 = 9-inches)


Type M Riprap (D50 = 12-inches)

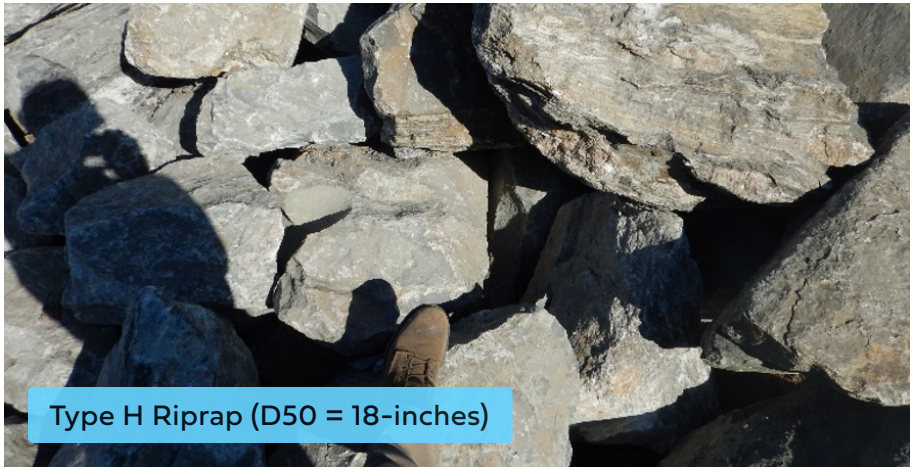

Type H Riprap (D50 = 18-inches)

Table 1: Riprap Gradation

Riprap Designation	% Smaller than Given Size by Weight	Intermmediate Rock Dimension (inches)	d_{50}* (inches)
Type VL	70 - 100 50 - 70 35 - 50 2 - 10	12 9 6 2	6
Type L	70 - 100 50 - 70 35 - 50 2 - 10	15 12 9 3	9
Type M	70 - 100 50 - 70 35 - 50 2 - 10	21 18 12 4	12
Type H	70 - 100 50 - 70 35 - 50 2 - 10	30 24 18 6	18
Type VH	70 - 100 50 - 70 35 - 50 2 - 10	41 33 24 9	24

***d_{50}** - Mean Particle Size

Soil Riprap Mixing

STEP 2
(Soil Riprap Mixing):

- Soil riprap is created by mixing 2/3 riprap with 1/3 soil by volume. Soil material should be native or topsoil.
- Front end loaders or excavators should be used to scoop up the riprap and soil material and add into a combined mixing pile.
- Verify that the proper proportions of the riprap and soil are used.
- Verify that the materials are thoroughly mixed using a loader or large track excavator. The final product should consist of a uniform mixture of soil and riprap without voids.

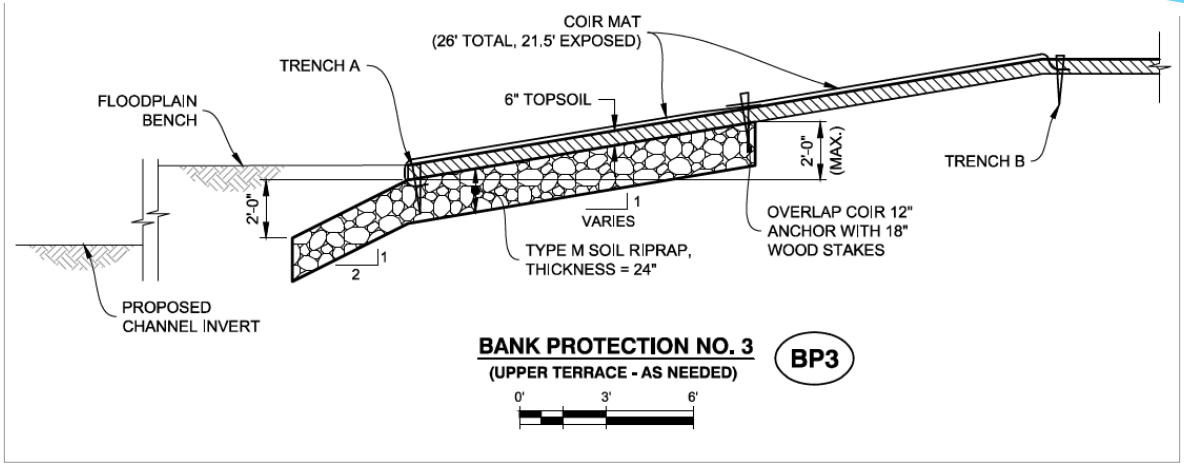
Soil riprap being mixed

Conventional/Soil Riprap Subgrade

STEP 3 (Subgrade):

Verify that the subgrade is prepared prior to riprap installation.

- Confirm that areas to receive riprap are excavated to a depth that accounts for the riprap thickness, topsoil and granular bedding thickness if specified.
- Subgrade should be firm and unyielding.
- There should be no groundwater present during riprap installation.



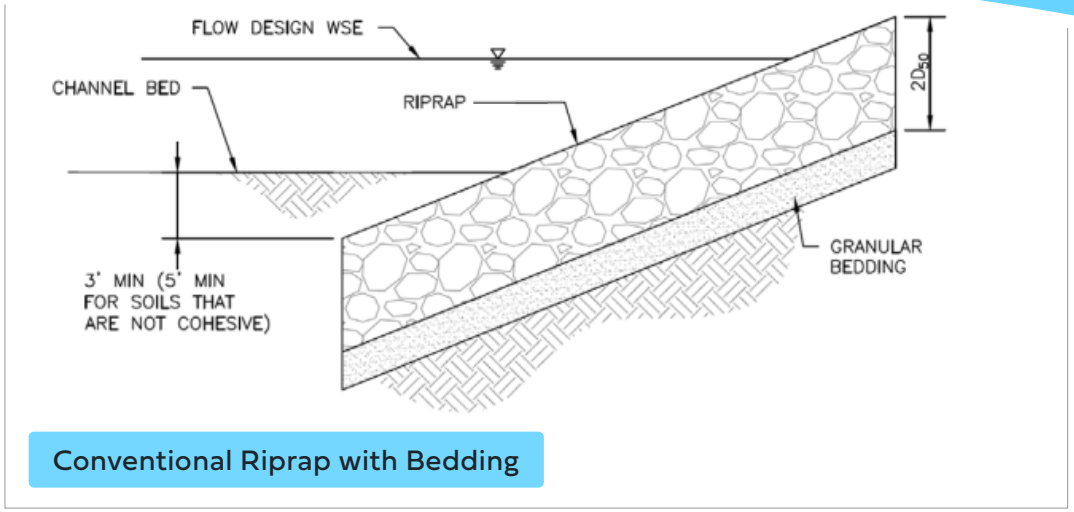
Excavated subgrade for riprap

Conventional/Soil Riprap Installation

STEP 4 (Bedding):

Granular bedding material is generally required under conventional riprap to prevent piping of underlying subgrade soils. It is not typically required for soil riprap. Verify that:

- Granular bedding is crushed, angular rock that meets gradation requirements.
- Granular bedding is placed at specified thickness.



Conventional Riprap with Bedding

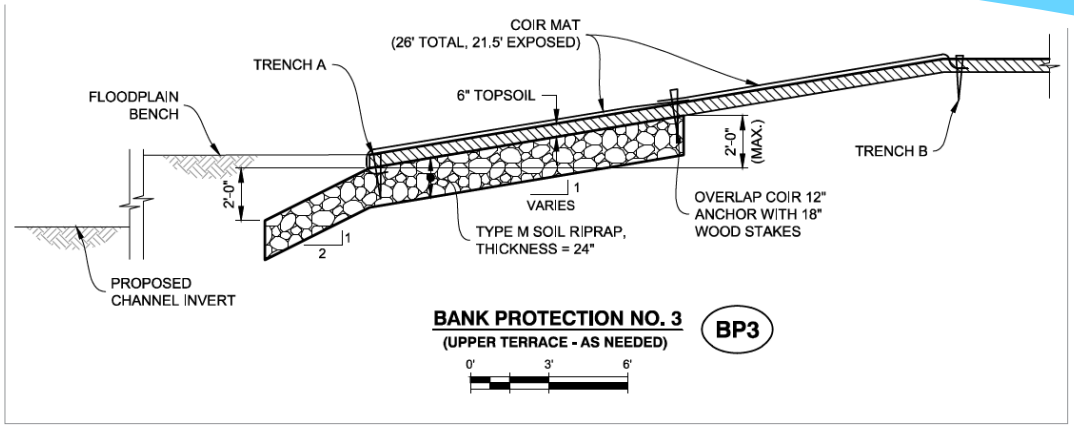
Granular Bedding

Conventional/Soil Riprap Installation

STEP 5 (Installation):

Riprap should be installed to the lines and grades shown on the plans. Verify that:

- Riprap is placed at thickness specified.
- Riprap is placed and well distributed such that there are no large accumulations of either smaller or larger sizes of stone. If segregation occurs during placement, riprap will need to be reworked to ensure that it is well mixed.
- Larger rock material is flush to the top surface and arranged to minimize voids with smaller rock material in between.



Soil riprap installation complete before topsoil placement

STEP 5 (Installation continued):

- Make sure that conventional and soil riprap is consolidated and compacted with an excavator bucket (plated) or a tracked piece of equipment to smooth the surface and interlock the rock material.

- For soil riprap, verify that there are no excessively thick zones or pockets of soil that could create a weak spot and be prone to washing out.

Conventional/Soil Riprap Installation

STEP 5 (Installation continued):

- Following placement, soil riprap is sometimes specified to be buried with several inches of topsoil.

Soil riprap installed and ready to be covered with topsoil

Finished Installation

After placing and compacting, conventional riprap should be relatively smooth on top with larger rock visible on the surface and smaller rock in between.

Finished installation of conventional riprap at bridge abutment

Finished Installation

After mixing, placing and compacting, soil riprap should be smooth on the surface and all the voids filled with soil.

Finished installation of soil riprap along channel bank (prior to being covered with topsoil)