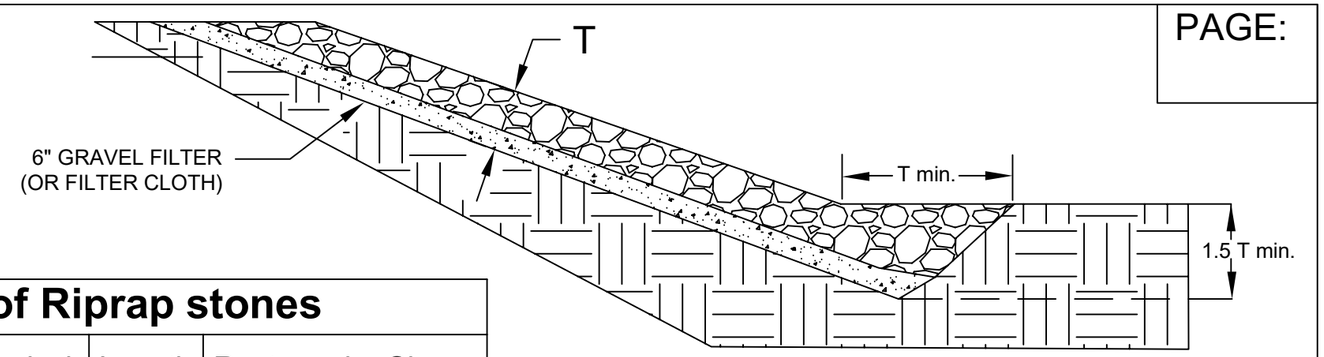
DATE:

PAGE:



Subgrade Preparation:

1. Prepare the subgrade for riprap and filter to the required lines and grades shown on the plans.
2. Compact any fill required in the subgrade to a density approximating that of the surrounding undisturbed material or overfill depressions with riprap.
3. Remove brush, trees, stumps, and other objectionable material.

Sand and Gravel Filter Blanket:

1. Place the filter blanket immediately after the ground foundation is prepared.
2. When using gravel, spread filter stone in a uniform layer to the specified depth.
3. When more than one layer of filter material is used, spread the layers with minimal mixing.

Synthetic Filter Fabric:

1. Place the cloth filter directly on the prepared foundation.
2. Overlap the edges by at least 12 inches, and space anchor pins every 3 feet along the overlap.
3. Bury the upstream end of the cloth a minimum of 12 inches below ground and bury the lower end of the cloth or over lap with the next section as required.
4. If damage occurs while placing riprap, remove the riprap, and repair the sheet by adding another layer of filter material with a minimum overlap of 12 inches around the damaged area. If damage is extensive, remove and replace the entire sheet.
5. If placing large stones or machine placing is difficult, a 4 inch layer of fine gravel or sand may be needed to protect the filter cloth.

Maintenance:

In general, once a riprap installation has been properly designed and installed it requires very little maintenance. Riprap should be inspected periodically for scour or dislodged stones. Control of weed and brush growth may be needed in some locations.

Size of Riprap stones

Weight (lb)	Mean Spherical Diameter (ft)	Length (ft)	Rectangular Shape Width/Height (ft)
50	0.8	1.4	0.5
100	1.1	1.8	0.6
150	1.3	2.0	0.7
300	1.6	2.6	0.9
500	1.9	3.0	1.0
1000	2.2	3.7	1.3
1500	2.6	4.7	1.5
2000	2.8	5.4	1.8
4000	3.6	6.0	2.0
6000	4.0	6.9	2.3
8000	4.5	7.6	2.5
20,000	6.1	10.0	3.3

Sizes for Riprap and Erosion Control Stone Specified by NCDOT

Riprap		Erosion Control	
Class 1	**Class 2**	**Class A**	**Class B**
5-200 lb	25-250 lb	2"-6"	5"-15"
30% shall weigh a minimum of 60 lbs each	60% shall weigh a minimum of 100 lbs each		
No more than 10% shall weigh less than 15 lbs each	No more than 5% shall weigh less than 50 lbs each	10% tolerance top and bottom sizes	
		Equally distributed, no gradation specified	Equally distributed, no gradation specified

Riprap should be a well-graded mixture with 50% by weight larger than the specified design size.
Diameter of the largest stone size in the mix should be 1.5 times the d_{50} size with smaller sizes grading down to 1 inch.

Stone Placement:

1. Placement of riprap should follow immediately after placement of the filter.
2. Place so that riprap forms a dense, well-graded mass of stone with a minimum of voids.
3. Place to its full thickness in one operation.
4. Do not place by dumping through chutes or other methods that cause segregation of stone sizes.
5. Take care not to dislodge underlying base or filter when placing stone.
6. The toe of the riprap slope should be keyed to a stable foundation at its base.
7. The toe should be excavated to a depth about 1.5 times the design thickness of the riprap and extend horizontally from the slope, as shown above.
8. Hand placing may be necessary to achieve the proper distribution of stone sizes to produce a relatively smooth, uniform surface.

NORTH CAROLINA Department of Environmental Quality

RIP RAP

Effective Date: 9/1/2023
In accordance with the 2013 Design Manual Updates