

DELAWARE CONSTRUCTION SPECIFICATION

GRouted ROCK RIPRAP CS 52

1. SCOPE

The work shall consist of furnishing, transporting, and placing rock and concrete grout in the construction of grouted rock riprap sections.

2. MATERIALS

Rock for grouted rock riprap shall conform to the requirements of Delaware Material Specification 213, or if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other materials not meeting the required gradation limits.

Prior to delivery of rock from other than designated sources, the Contractor shall designate, in writing, the source from which he intends to obtain the rock and information satisfactory to the NRCS Technician that the material meets the requirements of the contract. The Contractor shall provide the NRCS Technician free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified on the drawings.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements shown on the drawings. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall unless otherwise specified, conform to the requirements of Delaware Material Specification 214 and 215.

Portland cement shall conform to the requirements of Delaware Material Specification 202 for the specified type.

Pozzolan. Unless otherwise specified on the drawings, pozzolans conforming to Specification ASTM C-618 class F in amounts not to exceed 20 percent, based on absolute volume, may be substituted for an equivalent amount of portland cement in the grout mixture.

Aggregates shall conform to the requirements of Delaware Material Specification 203, except that the grading for coarse aggregate shall be as specified on the drawings.

Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of ASTM Specification C-260, Air-Entraining Admixtures for Concrete.

Curing compound shall conform to the requirements of Delaware Material Specification 204.

Other admixtures, when required, shall be as specified in the construction details.

3. **SUBGRADE PREPARATION**

Riprap or filter shall not be placed until the subgrade surfaces have been inspected and approved by the NRCS Technician.

4. **FILTER LAYERS OR BEDDING**

When filter layers or bedding beneath the riprap is specified, the material shall be spread uniformly on the prepared subgrade surfaces to the depth shown on the prepared subgrade surfaces to the depth shown on the drawings. Compaction of the material will not be required but the surfaces of such layers shall be finished reasonably free of mounds, dips, or windrows.

5. **PLACING ROCK**

The rock shall be placed on the surfaces and to the depths specified in such a manner as to avoid displacement of the underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than the specified deviation from the neat lines shown on the drawings. Double decking of thin, flat rocks to bring the surface up to the required grade will not be permitted.

6. **DESIGN OF THE GROUT MIX**

The mix proportions for the grout mix shall be as specified in the construction details. During the course of the work the NRCS Technician

will require adjustment of the mix proportions whenever necessary. After the mix has been designated, it shall not be changed without the approval of the NRCS Technician.

7. **HANDLING AND MEASUREMENT OF MATERIAL**

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix. Except as otherwise provided in Section 11, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of the surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of + 3 percent.

8. **MIXERS AND MIXING**

The mixer, when loaded to capacity, shall be capable of combining the ingredients of the grout mix into a thoroughly mixed and uniform mass and of discharging it with a satisfactory degree of uniformity.

Mixer shall be operated within the limits of the manufacturer's guaranteed capacity and speed of rotation.

The time of mixing after all cement and aggregates are in the mixer drum shall be not less than one minute for mixers having a capacity of one cubic yard or less. For mixers of larger capacities, the minimum time shall be increased fifteen seconds for each cubic yard or fraction thereof of additional capacity. The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate, and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

When ready-mixed grout mix is furnished, the Contractor shall furnish to the NRCS Technician a delivery ticket showing the time of loading and the quantities of materials used for each load of grout mix.

No mixing water in excess of the amount called for by the job mix shall be added to the grout mix during mixing or hauling or after arrival at the delivery point.

9. **CONVEYING AND PLACING**

The grout mix shall be delivered to the site and placed within 1 ½ hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The NRCS Technician may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the final placement as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Grout mix shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

The grout mix shall not be placed until the rock riprap has been inspected and approved by the NRCS Technician.

Rock to be grouted shall be kept wet for at least 2 hours immediately prior to grouting.

The rock riprap shall be flushed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist just ahead of the actual placing, but the grout shall not be placed in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one course. On slopes, the grout shall be placed in two (2) courses in successive lateral strips approximately ten (10) feet in width starting at the toe of the slope and progressing to the top. The grout shall be delivered to the place of final deposit by approved means and discharged directly on the surface of the rock, using a splash plate of metal or wood to prevent displacement of the rock directly under the discharge. The flow of grout shall be directed with brooms, spades or baffles to prevent it from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets of rock and otherwise aid the penetration of grout so that all voids shall be filled and the grout fully

penetrates the rock blanket. All brooming on slopes shall be uphill and after the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing.

After completion of any strip or panel, no workman or other load shall be permitted on the grouted surface for a period of twenty-four (24) hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water and mechanical injury.

10. **CURING AND PROTECTION**

The surface of treatment materials shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

The grouted rock may be coated with an approved curing compound in lieu of continued application of moisture. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until finishing of that surface is completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above.

Grout mix shall not be placed when the daily minimum temperature is less than 40°F unless facilities are provided to insure that the temperature of the materials is maintained at not less than 50°F nor more than 90°F during placement and the curing period. Grout mix shall not be placed on frozen surfaces. When freezing conditions prevail, rock to be grouted must be covered and heated to a range of 50°F to 90°F for at least 24 hours prior to placing treatment materials.

11. **INSPECTING AND TESTING FRESH GROUT**

The NRCS Technician will inspect and test grout during the course of the work. Sampling of fresh grout will be done by the methods prescribed in

ASTM Designation C-172. The volume of each batch will be determined by the methods prescribed in ASTM Designation C-138.

The NRCS Technician shall have free entry to all parts of the Contractor's plant and equipment which concern mixing and placing the grout while work on the contract is being performed. Proper facilities shall be provided for the NRCS Technician to inspect materials and processes used in mixing and placing the grout as well as for securing samples of the grout mix. All tests and inspections shall be so conducted as not to interfere unnecessarily with the mixing and placing of the grout.

When ready-mixed grout is furnished, the Contractor shall furnish to the NRCS Technician a statement-of-delivery ticket for each batch delivered to the job site. The ticket shall show the total weights in pounds of cement, water, and fine and coarse aggregates, amount of air-entraining agent, time of loading, and the revolution counter reading at the time of batching.