

SECTION 02271

STONE PROTECTION
09/91

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88-83	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 127-84	Specific Gravity and Absorption of Coarse Aggregate.
ASTM C 131-81	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
ASTM C 136-84a	Sieve or Screen Analysis of Fine and Coarse Aggregates.
ASTM C 535-81	Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Machine.
ASTM D 1141-75	Substitute Ocean Water.

1.2 GENERAL

Work specified in this section consists of furnishing all plant, labor, equipment, materials, supplies and incidentals required for producing, transporting, and placing stone protection and riprap.

1.3 MEASUREMENT AND PAYMENT

1.3.1 Stone Protection and Riprap:

1.3.1.1 Measurement

All stone protection and riprap will be measured for payment by the number of tons (2,000 pounds/ton) of stone placed and accepted in the completed work. Tonnage will be determined by scale weight measurement.

1.3.1.2 Scale Weight Measurement

Scales used for measurement shall, at the option of the Contractor, be either public scales or approved scales provided by the Contractor. Weighing of material shall be at the point nearest the work at which a public scale is available or at which it is practicable for the Contractor

to provide a scale. Scales shall be standard truck scales of the beam type and shall be equipped with the type registering beam which imprints the weight on the ticket and on "over and under" indicator and be capable of accommodating the entire vehicle. Scales shall be tested, approved, and sealed by an inspector of the state in which the scale is located. Scales shall be calibrated and resealed as often as necessary and at least once every three months, to insure continuous accuracy. All calibrations and sealing of the scales shall be at the expense of the Contractor. The necessary number of standard weights for testing the scales shall be on hand at all times. If an official inspection bureau of the state is not available, the scales will be tested by the Contracting Officer. When the Contractor's scales are used, the Contractor shall be certified as a licensed weighmaster in accordance with all requirements of the State Inspection Bureau, and any employees of the Contractor engaged in weighing under the provisions of the State Inspection Bureau charged with scales inspections. No more than one licensed weighmaster shall be employed during a single shift of weighing operations. Multiple weighmasters including individual truck drivers are prohibited. Vehicles used for hauling materials shall be weighed empty daily at such time as desired, and each shall bear a plainly legible identification mark.

1.3.1.3 Way Bills and Delivery Tickets

Copies of way bills or delivery tickets shall be submitted daily to the Contracting Officer during the progress of the work. The Contractor shall furnish the Contracting Officer or his designated representative scale tickets for each load of material weighed, date, time, and location of loading. Individual tickets shall be delivered to the Contracting Officer or his representative at the time of delivery or at the end of each work shift. A master log of all vehicle loadings shall be furnished for each day of loading operations. The Contractor shall file with the Contracting Officer the master log of loadings, certified way bills and/or certified delivery tickets. Prior to final payment, the Contractor will furnish written certification that the material recorded on the submitted way bills and/or certified tickets was actually used in the construction covered under this contract.

1.3.1.4 Payment

Payment for the stone, measured as specified will be made at the contract price per ton for Item, "Stone Protection and Riprap." Prices for stone shall include all costs of furnishing, hauling, and placing of the stone as specified herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are For Information Only. The following shall be submitted in accordance with Section 01330:

SD-01 Data

Source of Material; GA.

Source of Material; Name and location of quarry, exploratory data and compliance test reports, and service roads.

SD-08 Statements

Way bills and Delivery Tickets; FIO.

Copies of way bills or delivery tickets shall be submitted as stated in paragraph 1.3.1.3.

SD-09 Reports

Reports; FIO.

Quality compliance testing required. Gradation Tests; Gradation test results shall be performed in accordance with paragraph 2.1.4.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Source and Material Approval

The Contractor shall make all arrangements, pay all royalties, and secure all permits for the procurement, furnishing and transporting of materials. The sources from which the Contractor proposes to obtain the material shall be selected and a sample submitted a minimum of 30 days in advance of the time when the material will be required in the work. Stone from a proposed source where exploratory investigations and compliance test reports or satisfactory service records are not available, will be tested by the Government for quality compliance. The Government will test one sample at its expense. If the material fails the tests or if the Contractor desires to utilize more than one source, additional testing will be accomplished by the Government for the sum of \$3600.00 for each sample tested. The costs of such tests will be deducted from payment due the Contractor. All test samples (500 pounds minimum) shall be representative of the rock source and shall be obtained by the Contractor under the supervision of the Contracting Officer and delivered at the Contractor's expense to the South Pacific Division Laboratory at Sausalito, California. A list of sources from which acceptable stone protection materials have been obtained is available for informational purposes in the Geotechnical Branch of the Sacramento District, Corps of Engineers. Sources listed may no longer be available due to depletion or may not be acceptable because of changes in the material. The Contractor shall vary the quarrying, processing, loading and placing operations to secure the type and quality of stone protection specified. If the stone being furnished by the Contractor does not fully meet all the requirements of these specifications, the Contractor shall furnish at no additional cost to the Government, other stone meeting the requirements of these specifications. Approval of stone from a source shall not be construed as a waiver of the right of the Government to require the Contractor to furnish stone which complies with these specifications. Materials produced from localized areas, zones or strata will be rejected when such materials do not comply with the specifications.

2.1.2 Quality Compliance

Test results and service records may be used to determine the acceptability of the stone protection materials. In the event compliance test reports and/or service records are not available, the material shall be subjected to the tests outlined in these specifications to determine its acceptability for use in the work. Before a proposed new source of stone will be considered for sampling and testing, one of the following criteria must be met:

- a. A sufficiently developed quarry operation to demonstrate that an adequate quantity of stone is available to fulfill the contract requirements; or,

b. An exposed face plus sufficient explorations (results of which are made available to the Government) to demonstrate that an adequate quantity of stone is available to fulfill the contract requirements.

2.1.1.3 Quality Compliance Tests for Stone Protection

Stone shall meet the following test requirements:

Test	Test Method	Requirement
Specific Gravity (Bulk SSD)	ASTM C 127	2.50 Minimum
Absorption	ASTM C 127	2.0% Maximum
Wetting and Drying	SPD Test	No Fracturing
Magnesium Sulfate	ASTM C 88 (2)	10% max. Loss
Abrasion Loss	ASTM C 535	50% max. Loss

In addition to the above tests, the stone shall be subjected to a petrographic and x-ray diffraction analysis. The stone must not contain any swelling type clay (illite or montmorillonite).

NOTE: (1): Test procedure wetting-and-drying tests: The initial step of the test is the careful examination of the entire sample and the selection of representative test specimens. The piece should be large enough to produce two cut slabs, 1 inch thick (1/4 inch) with a minimum surface area of 30 square inches on one side. Two chunks approximately three by four inches are also chosen. The slabs and chunks are carefully examined under a low power microscope and all visible surface features are noted and recorded. The specimens are then oven dried at 140 degrees Fahrenheit, for eight hours, cooled and weighed to the nearest tenth of a gram. The test specimens are photographed to show all surface features before the test. The chunks and slabs are then subjected to fifteen cycles of wetting and drying. One slab and one chunk are soaked in fresh tap water, and the other slab and chunk are soaked in salt water prepared in accordance with ASTM D 1141. Each cycle consists of soaking for sixteen hours at room temperature and then drying in an oven for eight hours at 140 degrees Fahrenheit. After each cycle the specimens are examined with the low-power microscope to check for opening or movement of fractures, flaking along edges, swelling of clays, softening of rock surface, heaving of micaceous minerals, breakdown of matrix material and any other evidence of weakness developing in the rock. The cycle in which any of these actions occurs is recorded. After fifteen cycles, the slabs and chunks are again carefully examined and changes in the rocks are noted and recorded. The test specimens together with all flakes or particles which come off during the test are oven dried, weighed and photographed.

NOTE: (2): The test shall be made of 50 particles each weighing 100 grams (\pm 20 grams), in lieu of the gradation given in ASTM C 88.

NOTE: (3): Weakening and loss of individual surface particles is permissible unless bond of the surface grains softens and causes general disintegration of the surface material.

NOTE: (4): Sandstones which have a loss greater than the specified limit will be accepted if the Contractor demonstrates that the rock has a satisfactory service record.

2.1.4 Gradation Sampling and Testing for Stone Protection

Tests shall be performed by the Contractor's quality control organization (or approved testing laboratory) on samples selected by the Contracting Officer. The Government reserves the right to perform check tests and to use the Contractor's sampling and testing facilities to make the tests. Each sample shall consist of not less than five tons of materials and shall be selected at random from the production run. One gradation test is required at the beginning of production prior to delivery of stone to the project and a minimum of one additional test for each 10,000 tons of material placed. All sampling and gradation tests performed by the Contractor shall be under the supervision of the Contracting Officer.

2.1.5 Gradation

2.1.5.1 General:

All points on each individual grading curve shall be between the boundary limits as defined by a smooth curve drawn through specified grading limits plotted on a mechanical analysis diagram. The individual grading curves shall not exhibit abrupt change in slope denoting skip grading or scalping of certain sizes. Specified grading of all material shall be met both at the source and as delivered to the project. In addition, material not meeting the required grading due to segregation or degradation during placement shall be rejected. If test results show that the stone does not meet the required grading, the hauling operation will be stopped immediately and will not resume until rock processing procedures are adjusted and a gradation test is completed showing gradation requirements are met. All gradation tests are at the expense of the Contractor.

2.1.5.2 Stone Protection:

Stone protection shall be quarry stone, as specified below. Quarry stone shall be angular in shape. Neither the breadth nor the thickness of any piece of stone shall be less than one-third its length. Quarry stone as placed in any portion of the completed layer shall meet the following gradations:

Gradation for Stone Protection - Quarry Stone

Weight of Pieces (Lbs.)	Percent Smaller by Weight
170	100
100	70-95
50	40-65
35	30-55
10	10-25
5	5-15
2	0-5

PART 3 EXECUTION

3.1 FOUNDATION PREPARATION

Areas on which stone protection is to be placed shall be trimmed and dressed to conform to cross sections shown on the drawings within an allowable tolerance of minus 0 to plus 3 inches. The Contractor shall provide surveyed cross sections taken after the emplacement of embankment fill and sheet pile sections and before the placement of riprap and stone protection. Where areas of the embankment area below grade, they shall be

brought to grade by filling with well earth similar to adjacent material. No additional payment will be made for material thus required. The areas repaired shall be re-surveyed and the cross section notes given to the Contracting Officer's Representative (COR) for checking prior to the stone placement. Immediately prior to placing the stone protection and the riprap, the prepared base will be inspected by the COR and no stone protection shall be placed thereon until that area has been approved by the COR.

3.2 PLACEMENT

Stone protection and/or riprap will be used within the limits shown on the drawings or as staked in the field. The stone material shall conform to the requirements of Paragraph 2.1.5, Gradation as to quality. Equipment will not be permitted on the finished surface of the stone protection or the riprap material.

-- End of Section --