

HYBRID ROCK FALL BARRIER/DRAPE SYSTEM

****From Hartford-Newbury IM 091-2(72)**

xx. DESCRIPTION. This work consists of furnishing and installing a hybrid rock fall barrier/drape rock slope protection system at the locations indicated in the Plans and as directed by the Engineer.

xx. MATERIALS.

(a) General. The hybrid system consists of a modified rock fall catch fence that transitions into a ring net drape down slope. The intention of the system is to provide catchment and control of future rock falls. The hybrid drape/fence ring net protection system includes support ropes, ring net panels, ground anchors, post foundations, and chain link material. Anchor and foundation requirements will vary by manufacturer and design of these elements shall be provided by the supplier.

The upper fence portion of the hybrid system shall be based on a 2000 kilojoules (740 ft-tons) rock fall barrier, and the ring net panels shall have a minimum demonstrated breaking strength of 75 metric tons (82.7 tons).

The system proposed by the Contractor shall be supplied as a "kit". The system shall have been previously used and shall have demonstrated satisfactory performance in similar applications and capacities.

(b) Wire Rope. Wire rope for nets, support ropes, seam ropes, and wire rope anchors shall meet Federal Specification R-R-W-410D or equivalent.

(c) Ring Nets and Fabric. Fabric used for the drape shall consist of ring net panels developed for rock slope stabilization and rock fall applications having a minimum strength of 200 kN/m² (4200 psf). Ring net panels shall be backed with chain-link fabric to limit penetration by rocks smaller than the ring net apertures.

The ring net fabric shall be fabricated with 3 mm (0.12 inch) diameter or greater high strength 200 ksi galvanized steel wire and turned seven times to form a steel strand of 11 mm x 350 mm (0.43 inch x 13.8 inches). The linked ratio of the rings shall be of one ring connected to six rings. The minimum strength of the panels shall be demonstrated to be at least 75 metric tons (82.7 tons).

(d) Chain-Link Mesh. Nets shall be covered with chain-link mesh material which shall be attached to the wire rope nets with galvanized hog rings or galvanized tie wire.

Chain-link material shall be 9 gage, minimum, 50 mm (2 inches) chain-link or 203 mm x 254 mm (8 inches x 10 inches) double-twisted hexagonal wire mesh conforming to

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AASHTO M 181-86 and shall be zinc coated in accordance with ASTM A 392-84, Class 1 standards.

The chain-link shall be attached on the outside of the nets and the fasteners placed on the top longitudinal wire rope of the hybrid drape/fence on 0.61 meter (2 feet) centers, and attached with an open pattern of fasteners in the drape portion of the hybrid to maintain flexibility of the system, as approved by the Engineer and Agency Geologist (Geologist).

- (e) Miscellaneous Materials. All miscellaneous material such as wire rope clips, thimbles, bolts, etc., shall be supplied by the vendor with the system.

All miscellaneous material associated with the slope protection system such as wire rope clips, thimbles, bolts, etc., shall be hot-dipped galvanized.

- (f) Galvanizing. All wire shall be galvanized per ASTM A 641-92 for zinc coated (galvanized) carbon steel wire.

The minimum weight of the coating shall be in accordance with Table 1 of the Standard when tested in accordance with ASTM A 90-91.

The adhesion of the zinc coating to the wire should be such that, when the wire is wrapped six turns around a mandrel of four times the diameter of the wire, it does not flake or crack to such an extent that any zinc can be removed by rubbing with bare fingers.

Hog rings and tie wire shall be supplied with zinc coating to the weight specified in Table 1 of the Standard for the size wire.

- (g) Certification. The Contractor shall furnish a certified report of tests by an independent approved testing laboratory showing that the product to be supplied equals or exceeds these specifications.

The following manufacturers are capable of supplying a hybrid rock fall barrier/drape system that meets these specifications:

American Mountain Management, Inc.
Financial Plaza Building
1135 Terminal Way
Suite 106
Reno, NV 89502-2145

Geobruigg North America, LLC
551 W. Cordova Road
PMB 730
Santa Fe, NM 87505
Tel.: 505-438-6161
Fax: 505-438-6166
Website: www.geobruigg.com

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Requests for substitutions for the above shall be submitted to the Agency's Office of Contract Administration a minimum of 10 days in advance of the bid opening date. Substitutions for the above after award shall be approved by the Engineer and Geologist.

- xx. MARKING AND SHIPPING OF MATERIAL. All material shall be properly marked and tagged by the manufacturer.

The material shall be shipped and stored in accordance with methods recommended by the manufacturer.

- xx. SUBMITTALS.

(a) Qualifications. Not less than two weeks prior to beginning the work, the Contractor shall provide in writing qualifications of Contractor's personnel to the Engineer and Geologist for approval. The supervisors shall have a minimum of five years of demonstrated experience in the installation of rock fall barriers and draped wire mesh systems of similar nature, while equipment operators and laborers shall have a minimum of two years.

(b) Installation Plan. Not less than two weeks prior to beginning the work, the Contractor shall submit a detailed plan for the draped wire mesh system installation. The plan shall include:

- (1) The proposed construction work plan and schedule.
- (2) The proposed drilling method and equipment.
- (3) Anchor and foundation design drawings and specifications.
- (4) Manufacturer's certificates for wire ropes, ring net panels, cable anchors, and chain-link material.
- (5) Detailed manufacturer's instructions for installation of the hybrid system.

(c) Fabrication Drawings. The Contractor shall submit detailed Fabrication Drawings of the hybrid drape/fence ring net system to the Engineer and Geologist for review and approval. The Fabrication Drawings shall include the following minimum information:

- (1) Type and diameter of all wire ropes.
- (2) A full list and description of parts included in the hybrid system "kit".
- (3) Cable anchor locations, type, and pull-out strength.
- (4) Grout type and mix design.

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(5) Testing Plan for anchors.

- (d) Certification. The Contractor shall submit a certification from the manufacturer that the system is designed to absorb the specified impact loads without passage of the object through the barrier.

Work shall not begin until the submittals have been approved in writing by the Engineer and Geologist.

- (e) Field Reports. The Contractor shall submit a field report on a daily basis to the Engineer and Geologist for approval. The field report shall include the location, description, and area of draped wire rope net system installed.

- xx. INSTALLATION. The Contractor shall scale slope faces as shown on the Plans to remove loose, unstable rock and debris and dispose of this rock and debris at locations approved by the Engineer and Geologist prior to installation of the wire rope slope protection system.

Work shall proceed according to the installation plan submitted by the Contractor.

The manufacturer shall provide, at a minimum and free of charge, one eight hour day of installation supervision by a qualified field engineer in order to ensure that the system is properly installed.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Hybrid Rock Fall Barrier/Drape System, Fence Component) to be measured for payment will be the number of meters (linear feet) installed in the complete and accepted work. Measurement will be along the top of the fence from outside to outside of end posts for each continuous run of fence.

The quantity of Special Provision (Hybrid Rock Fall Barrier/Drape System, Drape Component) to be measured for payment will be the number of square meters (square feet) placed in the complete and accepted work.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Hybrid Rock Fall Barrier/Drape System, Fence Component) will be paid for at the Contract unit price per meter (linear foot).

The accepted quantity of Special Provision (Hybrid Rock Fall Barrier/Drape System, Drape Component) will be paid for at the Contract unit price per square meter (square foot).

Payment for these items will be full compensation for detailing, furnishing, handling, assembling, and placing the materials specified, including all ties, lacing, wire, clips, hog rings, chain-link material, anchors, plates, kits, and grouted cable anchors and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

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Payment for preparing and making required submittals will not be made separately, but will be considered incidental to the work under this Section.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.640 Special Provision (Hybrid Rock Fall Barrier/Drape System, Fence Component)	Meter (Linear Foot)
900.670 Special Provision (Hybrid Rock Fall Barrier/Drape System, Drape Component)	Square Foot
900.675 Special Provision (Hybrid Rock Fall Barrier/Drape System, Drape Component)	Square Meter