Make the following Section a part of the Standard Specifications:

"SECTION 670 – DRAPED WIRE MESH

670.01 Description. This section is for constructing a draped wire mesh on the slope according to the contract.

670.02 Materials. Materials for the draped wire mesh shall be of non-raveling construction and shall consist of a uniform triple twisted hexagonal mesh of zinc-coated steel wire. The zinc-coated wire core shall have a diameter of approximately U.S. Gage 12. The wires used in the fabrication of the netting shall comply with or exceed Federal Specifications QQ-W-461H, possessing soft tempered tensile strength of 70,000 psi as specified in ASTM A 641, Class 3 coating and a PVC coating (black color matte finish) extruded onto the wire core with zinc coating before weaving the coated wire into a triple twisted hexagonal mesh having uniform approximate openings of 3¼ inches by 4½ inches or smaller.

The overall diameter (zinc-coated wire core plus PVC coating) of the rockfall protection netting (draped wire mesh and modified draped wire mesh) shall be 0.1363 inches. Selvedge wire shall be of heavily zinc-coated wire core of 0.1338 inches in diameter (approximately U.S. Gage 10), coated with PVC and having an overall diameter (zinc-coated wire core plus PVC coating) of 0.1368 inches. Lacing wire, where required, shall be of heavily zinc-coated wire core of 0.0866 inches in diameter (approximately U.S. Gage 13-1/2), coated with PVC and having an overall diameter (zinc-coated wire core plus PVC coating) of 0.1166 inches. The above wire diameters are subject to a tolerance limit of 0.004 inches according to ASTM A 641.

Alternately, draped wire mesh of non-raveling construction and consist of a uniform diamond-shaped mesh of zinc/aluminum-coated steel wire may be used. The zinc/aluminum-coated wire core shall have a diameter of approximately 0.079 inch. The wire shall be alloyed high strength carbon steel wire with a minimum tensile strength of 256 ksi. The wire shall be galvanized with a zinc/aluminum coating with a minimum weight of 0.35 oz/ft^2 and powder coated black in color matte finish.

A. PVC (Polyvinyl Chloride) Coating. The protective PVC plastic coating shall be suitable to resist deleterious effects of natural weather exposure, immersion in salt water, and shall not show material difference in its initial physical properties. The initial properties are as follows:

(1) Specific Gravity of 1.30 to 1.35 kg/dm^3 according to ASTM D 792.

(2) Durometer Hardness shall be 50 to 60, Shore D according to ASTM D 2240.

(3) Volatile Loss (ASTM D 1203) ISO 176-1976 at 105°C for 24 hours shall be a maximum of 2% and at 105°C for 240 hours shall be a maximum of 6%.

(4) Tensile Strength shall not be less than 210 kg/cm^2 according to ASTM D 412.

(5) Elongation shall not be less than 200% and not be higher than 280% according to ASTM D 412.

(6) Modulus of Elasticity at 100% elongation shall not be less than 190 kg/cm^2 according to ASTM D 412.

(7) Abrasion weight loss shall not be more than 0.19 grams according to ASTM D 1242.

(8) Cold Bend Temperature shall not be higher than -30° according to BS 2782-104A (1970).

(9) Cold Flex Temperature shall not be higher than +15°C according to BS 2782-150B (1976).

(10) Creeping corrosion penetration of corrosion of the wire core from a square cut end shall be 25 mm when the specimen has been immersed for 2,000 hours in a 50% solution of HCL (Hydrochloric Acid 12 Be).

(11) Accelerated aging tests and properties after aging tests.

(a) Salt spray test according to ASTM B 117 with a test period of 1,500 hours.

(b) Exposure to ultraviolet light shall be according to ASTM D 1499 and ASTM G 23, Apparatus E, with a test period of 2,000 hours at 63°C.

(c) Exposure to high temperature according to ASTM D 1203 (ISO 176-1976) and ASTM D 2287 with a test period of 240 hours at 105°C.

(d) The vinyl coating shall not crack, blister, or split and shall not show remarkable change in color after aging tests.

(e) Specific gravity of the PVC coating shall not show change higher than 6% of its initial value after aging tests.

(f) Durometer hardness shall not show change higher than 10% of its initial value after aging tests.

(g) Tensile strength shall not show a change higher than 25% of its initial value after aging tests.

(h) Elongation shall not show change higher than 25% of its initial value after aging tests.

(i) Modulus of Elasticity shall not show change higher than 25% of its initial value after aging test.

(j) Resistance to abrasion shall not show change higher than 10% of its initial value.

(12) Brittleness Temperature. Cold bend temperature shall not be higher than -20°C after aging tests. Cold flex temperature shall not be higher than +18°C after aging tests.

(13) Durometer Hardness shall be 50 to 60, Shore D according to ASTM D 2240.

(B) Mesh Deformation. The wire mesh shall have deformability sufficient to permit a minimum mesh elongation equivalent to ten percent (10%) of the unstretched length of the mesh test. Mesh deformation shall not reduce the gauge or tensile strength of the individual wire strands to values less than those for similar wire one gauge smaller in diameter after aging tests.

(C) Miscellaneous Steel Hardware. No. 9 gage tie wire shall conform to ASTM A 112 with Class A coating and shall be PVC coated.

670.03 Construction Requirements.

(A) General. Installation of rockfall protection netting (draped wire mesh) shall commence no later than one week after completion of slope scaling in the specified limits of work. Install the rockfall protection netting (draped wire mesh) in accordance with the contract requirements or as specified by the Engineer. The Engineer will determine the final locations and the limits of the

rockfall protection netting (draped wire mesh) in the field during construction after a review and/or inspection of the site conditions with the scaling supervisor. The Contractor shall provide a temporary 0.5-inch wire rope onto two adjacent grouted rock anchors to serve as a 'life line' for the State's personnel during the inspection of the work. Install and move the 'life line' as directed by the Engineer.

The Contractor shall submit to the Engineer shop drawings providing details of the grouted rock anchor (including lateral anchor and bottom anchor) assembly and tagline connection details based on the manufacturer's recommendations for review and approval. The Engineer shall have a minimum of 20 working days after receipt of the submittal to review and provide comments to the submittal.

The Contractor shall submit to the Engineer details of the rockfall protection netting (draped wire mesh) and associated hardware including the pertinent technical data, shop drawings, samples of the materials, and color(s) of the netting matching as closely the color(s) of the slope for selection and approval by the Engineer prior to placing an order for the rockfall protection netting (draped wire mesh). The Engineer shall have a minimum of 20 working days after receipt of the submittal to review and approve the submittal. The Contractor shall not place an order for the rockfall protection netting (draped wire mesh) until written approval of the submittal is received from the Engineer.

(B) Drilled Holes. Drill the holes for the grouted rock anchors (including the lateral anchors and bottom anchors) according to the dimensions (diameter and depths) shown in the Contract Documents. The Contractor shall submit deviations from the dimensions shown on the Contract Documents for acceptance by the Engineer. The Engineer will not permit blasting for installation of the drilled holes.

If during the course of the drilled hole installation, the Contractor encounters unstable slope conditions that may constitute a potential rockfall hazard, immediately stop drilling and notify the Engineer.

(C) Grouted Rock Anchor (including top anchors and bottom anchors). Thread the steel rock anchor for the grouted rock anchors (including the top anchors and bottom anchors) with the standard threads on the exposed end only. The steel rock

anchor for the grouted rock anchors shall be ASTM A 615, Grade 75. Furnish each grouted rock anchor (or lateral anchor and bottom anchor) complete with hardware for the tagline connection or lateral anchor connection as shown on the Contract Documents including all necessary hardware, such as the following:

(1) Two 8 inch square by 0.375 inch thick steel plates (ASTM A 36) for the grouted rock anchor and bottom anchor or two 8 inch square by 0.375 inch thick steel plates (ASTM A 36) for the lateral anchor;

(2) Two heavy hex nuts (ASTM A 563, Grade A);

(3) One washer (ASTM F 436);

(4) Two heavy duty wire rope thimbles;

(5) One 6 inch inside diameter, 1.375 inch thick steel ring (ASTM A 572, Grade 42) for the top anchors only;

(6) All necessary wire rope clips (or cable clamps) (ASTM A 307).

Zinc-coat all metal parts, with the exception of stainless steel parts, according to Subsection 712.10 – Zinc-Coating.

(D) Proof Testing of Grouted Rock Anchors and Lateral Anchors. Perform proof testing of grouted rock anchors and lateral anchors on a minimum of 20 percent of the total number of grouted rock anchors (including lateral anchors). Proof testing of the bottom anchors will not be required. Perform the proof tests on anchors selected by the Engineer. Do not perform the proof testing until the grout for the anchor has cured for at least 72 hours and attained at least the specified 3-day compressive strength. Testing in less than 72 hours will only be allowed if the Contractor submits compressive strength test results, for tests performed by a qualified independent test lab, verifying that the anchor grout mixes being used will provide the specified 3-day compressive strengths in the lesser time.

Testing equipment shall include dial gauges, dial gauge support, jack and pressure gauge, electronic load cell, and a reaction frame. Provide description of test setup and jack, pressure gauge, and load cell calibration curves for review and approval by the Engineer. Measure the anchor head movement with a dial gauge capable of measuring up to 0.001 inches. The dial gauge shall have a travel

sufficient to allow the test to be done without having to reset the gauge. Visually align the gauge to be parallel with the axis of the anchor and support the gauge independently from the jack or reaction frame.

Proof test shall be performed by incrementally loading the anchor to a maximum test load of 133 percent of the pullout capacity indicated on the Contract Documents. The anchor head movement at each load shall be measured and recorded by the Engineer. The test load shall be monitored by a load cell or a jack pressure gauge with a sensitivity range meeting the requirements of pressure gauges used on the project. At load increments other than maximum test load, the load shall he held long enough to obtain a stable reading. Incremental loading for proof tests shall be in accordance with the following load schedule. The anchor head movements shall be recorded at each load increment.

PROOF TEST LOADING SCHEDULE	
LOAD	**HOLD TIME**
AL (0.05-DTL maximum)	Until Stable
0.25 DTL	Until Stable
0.50 DTL	Until Stable
0.75 DTL	Until Stable
1.00 DTL	Until Stable
1.25 DTL	Until Stable
1.33 DTL (Max. Test Load)	60 minutes

The alignment load (AL) should be the minimum load required to align the testing apparatus and should not exceed 5 percent of the Design Test Load (DTL). The DTL is the pullout capacity indicated on the Contract Documents. Dial gauges should be set to "zero" after the alignment load has been applied. All load increments shall be maintained within 5 percent of the intended load. The creep period shall start as soon as the maximum test load is applied and the anchor head movement shall be measured and recorded at 1 minute, 2, 3, 5, 6, 10, 20, 30, 50, and 60 minutes.

(E) Wire Rope. Install and connect the top anchor cable (horizontal wire rope) and stability cables (at the bottom and sides of the draped wire mesh) by steel U-bolts and nuts (wire rope clips or cable clamps) as shown in the Contract Documents and as specified by the Engineer. The amount of wire rope to turn back, the number of U-bolts and nuts, and the spacing between adjacent U-bolts and nuts shall be in strict accordance with the wire rope manufacturer's recommendations.

(F) Draped Wire Mesh. Before installing the draped wire mesh, the slope faces designated for slope scaling shown on the Contract Documents shall be scaled and cleaned of loose rocks and other materials. Overlap the draped wire mesh as shown in the Contract Documents at the selvedge edges of the adjacent netting panels and at the top and bottom overlapping. Tie the netting tightly to the top anchor cable (wire rope cable) and stability cables (at the sides and bottom of the draped wire mesh) as shown in the Contract Documents.

Movable temporary rockfall barrier shall be in-place during installation of the draped wire mesh at the specific times indicated on the Contract Documents only. The Contractor shall protect the traffic on the highway from any rockfall or other hazards at all times during the Contractor's activities.

Install the wire rope and heavy-duty type wire rope thimbles according to the manufacturer's recommendations. The heavy-duty type thimbles shall be of the size recommended by the manufacturer of the wire rope (minimum 2.5 inch seat diameter). Zinc-coat the heavy-duty thimbles according to Subsection 712.10 – Zinc-Coating.

670.04 Measurement. The Engineer will measure the draped wire mesh per square feet of actual finished surface excluding additional netting required for overlapping.

670.05 Payment. The Engineer will pay for the accepted draped wire mesh at the contract unit price per square feet complete in place. The price includes full compensation for furnishing and installing the materials including the grouted rock anchors (top and bottom anchors) including the steel rock anchor, steel plate, hex nuts and washer, heavy-duty wire rope thimbles, steel rings, stainless steel sleeve (swage), wire rope clips (or cable clamps); zinc-coating the steel rock anchor and all hardware, PVC coating on the draped wire mesh and tie wire, stainless steel ring fasteners, stability cables, and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work. Movable temporary rockfall barrier during installation of the draped wire mesh as specified in the Contract Documents will not be measured nor paid for separately and will be considered incidental to the unit price item.

Pay Item	Pay Unit
Draped Wire Mesh	Square Feet"

END OF SECTION 670