ITEM 607.9961 11 M - NOISE BARRIER SYSTEM (STRUCTURES)

DESCRIPTION

This work shall consist of furnishing and installing a NOISE BARRIER SYSTEM (STRUCTURES) in accordance with the contract documents and as directed by the Engineer.

The Contractor shall utilize the existing foundations that are already installed at the project site on the bridge structure and the soldier pile walls.

Post spacing for panel systems shall be as specified on the plans.

MATERIALS

The noise barrier shall meet the material requirements of 704-03 Precast Concrete - General or 718-01 Prestressed Concrete Units (Structural) with the following modifications and additions:

A. Structure Panels

1. Lightweight concrete shall be manufactured in accordance with Section 501, and the following modifications to Section 501:

   a. It will be the Contractor's responsibility to design a lightweight concrete mix, which will have a minimum compressive strength of 35 MPa at the end of 28 curing days.

   b. Cement Type 1 or 2 701-01

   c. Fine aggregate natural or manufactured 703-07

   d. Coarse aggregate (Lightweight aggregates) 703-10

      Coarse aggregate gradation shall conform to the 19 mm to 4.75 mm size designation in Table 1, ASTM C330.

   e. The minimum cement content shall be 385 kg per cubic meter.

      Air entrainment shall be a minimum of 4% and a maximum of 8% total air (entrapped plus entrained). Air content shall be determined by the volumetric method described in ASTM C173.

      The average dry unit weight of the cured concrete shall range between 1600 kg per cubic meter minimum to 1840 kg per cubic meter maximum when tested in accordance with ASTM C567.

   f. Stockpiles of lightweight aggregates shall be continuously and uniformly sprinkled with water for eight hours by means of a sprinkler system approved by the Engineer. The occurrence of a steady rain of comparable intensity will permit the turning off of the sprinkler system at the direction of the Engineer, until the rain ceases. At the end of the wetting period, or after the rain ceases, the stockpiles shall be allowed to drain for a period of twelve to fifteen hours immediately prior to use, unless otherwise determined by the Engineer.

   g. Lightweight air-entrained concrete shall be composed of portland cement, air-entraining admixture, water, fine aggregate and coarse aggregate proportioned in

accordance with the American Concrete Institute ACI 211.2, Recommended Practices for Selecting Proportions for Structural Lightweight Concrete.

h. After the materials have been accepted for this work, the Contractor shall determine the proportions for concrete and equivalent batch weights.

(1) Trial Mixes. The Contractor shall determine the proportions on the basis of trial mixes conducted with the materials to be used in the work in accordance with ACI 211.1, Recommended Practices for Selecting Proportions for Structural Lightweight Concrete. The corresponding cement content for each trial batch shall be determined by means of a yield test in accordance with ASTM C138.

(2) Proportions. The Engineer shall be provided a copy of the trial mix design including the following:

- The weight in kilograms of fine aggregate and coarse aggregate, (saturated surface-dry condition), per cubic meter of concrete.
- The cement content in kilograms per cubic meter.
- Quantity of water in kilograms per cubic meter.

These values shall be used to manufacture all lightweight concrete for this project.

(3) Batch Weights. The batch weights shall be submitted to the Engineer for approval. Since the proportions are designated in terms of aggregates in saturated surface-dry condition, the equivalent batch weights used by the Contractor shall be corrected periodically, to account for the moisture content of the aggregate at the time of use.

i. Lightweight coarse aggregates, together with approximately 2/3 of the total mixing water, shall be introduced into the mixer and mixed for a minimum of 10 minutes. The fine aggregate, cement and admixtures and remaining mixing water shall then be added, and mixing completed.

j. Air content, and slump placement limits, for lightweight concrete are as follows:

	Minimum	Desired	Maximum
Air Content (Measured by Roll-A Meter)	4.0%	6.0%	8.0%
Slump	____	65 mm-90 mm	100 mm

k. Concrete shall have an integral color pigment.

2. Sound Zero system (680 Ben Franklin Highway, Birdsboro, PA 19508, 610-385-6796) or approved equal shall be manufactured in accordance with the following:

a. Sound Zero or approved equal steel core (50 mm), an 1.2 mm, G-60 galvanized grade B steel - as per ASTM 526-80 M, Minimum I = 17.2 mm.

b. J-Channel 38 mm x 50 mm x 76 mm, 1.5 mm G-60 galvanized grade steel as per ASTM 526.80 M in lengths as required.

c. Passive restraint cables; 6 mm diameter galvanized wire rope - 6 mm diameter 7 x 19 IPS.RRL.IWRC with a flemish eye loop (76 mm x 152 mm) at both ends. Cables shall have a minimum 305 mm of "slack" and a minimum breaking strength of 3.2 metric tons.

d. Lifting insert; 19 mm diameter Nut, galvanized with flat plate.

e. EPS board; 16 kg/m^3 expanded polystyrene shall meet federal specification HH-I-524C Type I.

f. Mechanical fastener: A polypropylene washer designed for the mechanical attachment of insulation.

g. Fiberglass reinforcing fabric, 0.41 kg liter/square meter with a minimum tensile strength of 5.4 kg/mm of width.

h. Basecoat: An acrylic, latex modified cement B mix ratio: 1:1 - by weight. Used to embed fiberglass reinforcing fabric.

B. Structural Steel

Steel shall meet the requirements of Subsections 709-01, 709-04 and 715-01 or 563-2.02 and 709-06.

1. When base plates are used, they shall be fabricated from ASTM A572 steel and galvanized per 719-01, Type II.

2. When anchor bolts are used, they shall be hot-dipped galvanized ASTM A449 conforming to 723-60. Nuts shall be galvanized steel heavy hex nuts meeting the requirements of ASTM A194, Grade 2H.

3. Nuts attached to threaded rebars shall be carbon steel heavy hex nuts meeting the requirements of ASTM A194, Grade 2H. These nuts and all exposed rebars shall be coated, after assembly, with a galvanized repair material appearing on the Department's Approved List.

4. When threaded reinforcing is used as part of the design, the threads shall meet the requirements of ANSI B1.1

5. All exposed steel to be shop painted with three coats to match in color concrete panels in accordance with the Special Note on Preparation and Painting of Steel Surfaces, at the end of this specification.

C. Integral Color and Anti-Graffiti Coating

1. Integral Color

The precast concrete shall be integrally colored using a pigment coloring system meeting the requirements of ASTM C979. Pigment for integrally coloring concrete shall be a chemically pure material pigment, manufactured by a company with proven color mixes capable of producing approved custom colors complying with all environmental codes and ordinances and as approved by the Engineer. The admixture color shall produce a color conforming to the Federal Standard 595B. The color shall be as indicated on the Plans.

2. Anti-Graffiti Coating

Exposed concrete surfaces shall receive an anti-graffiti coating where indicated on the Plans. The anti-graffiti coating shall be a two-component, oil free, non-yellowing, aliphatic, polyester polyurethane coating. The material shall be approved by the Engineer prior to its application.

D. Backer Rod and Joint Sealer

The elastomeric sealant shall be polysulfide or polyurethane conforming to the requirements of Subsection 705-06.

The Backer Rod shall be polyetheylene foam, conforming to ASTM D3204, Type I.

E. Galvanizing

Components scheduled to be galvanized shall be galvanized by the hot-dip process to meet the requirements of ASTM A 123 and the requirements of subsection 719-01. The coating shall have the minimum zinc coating thickness indicated in the Table 1 of that standard.

1. Bolts, nuts and other hardware shall be hot-dip galvanized in accordance with ASTM A 153. Threaded holes shall have threads re-cut after galvanizing.

2. Touch-up of galvanized coating shall conform to the requirements of ASTM A 780 using material conforming to Federal Specification TT-P-641, Type I. The use of aerosol spray cans shall not be permitted.

3. After the components have been completely fabricated and all weldments ground smooth, the components shall be hot-dip galvanized in accordance with ASTM A 123. If a component is to be painted, then the dry kettle process shall be used. Water quenching of galvanized steel shall be prohibited.

4. Material for galvanizing shall be suitably fabricated for galvanizing in accordance with the most efficient provisions and requirements of ASTM A 385, as approved by the Engineer.

All galvanized steel components shall receive a shop applied coating system.
Primer Coat: Polyamide Epoxy, 3 to 5 mils Dry Film Thickness
Top Coat: High Build Aliphatic Polyurethane, 3 mils Dry Film Thickness

F. Miscellaneous

The materials listed below shall conform to the following subsections:

Concrete Grouting Material	701-05
Epoxy Polysulfide Grout	721-03
Neoprene Pads	728-01 or 728-02

Additional materials required specifically for use with structural concrete items shall meet the requirements of Subsections 556-2.01 and 556-2.02.

CONSTRUCTION DETAILS

FABRICATION (Structure Panels)

A. General

Fabricate the panels in an approved plant in accordance with approved drawings and approved quality control plan.

Fabricate, for approval, a 1.2 x 1.2 meter panel and finish as specified for the full height wall system, and erect at a location specified by the Engineer. Fabricate sample wall by the same process that will be used for all production. Panels not conforming to the approved test sample will be rejected.

Steel core units shall be supplied in proper lengths. Each of these units is designed to allow an overlap adjustment one to the other to obtain the required overall height of assembled steel core structure. Minimum overlap 19 mm.

Pieces shall be fastened together along the overlapping seams, with screws at 610 mm o.c. maximum.

J-Channel B shall be placed on both ends to the substrate and secured by welding or screw fastening. Note: All welds shall be touched-up with a zinc coating.

Wire rope with formed loops: (6.3 mm diameter 7 x 19 IPS.RRL.IWRC galvanized wire rope with a minimum breaking strength of 1.6 metric tons) shall be placed as shown on approved shop drawings, with the cables on the community side of the Noise Barrier system core. Cable shall be a minimum 0.305 m longer than the width of the panel. Loops shall be attached securely to the core by either plastic or steel strapping.

All surface oils and other foreign materials shall be wiped clean from the steel core structural unit prior to installing Sound Zero NR or approved equal.

Insulation (1/6 kg/m^3) shall be 610 mm x the full width, perpendicular to the steel core. The insulation shall be fastened using one per every 0.092 square meters.

Reinforcing fabric: The fiberglass reinforcing mesh shall be embedded into the basecoat, to encapsulate all six sides of the panel. The mesh shall be overlapped a minimum of 64 mm on all sides.

All the edges of the panel shall be coated with an elastomeric prior to finishing either face of the panel.

The approved finish is then applied to each face of the panel.

FABRICATION (Steel Posts)

A. General

The Contractor shall shop fabricate, structural steel posts and other metal parts as shown on the plans and in accordance with the provisions of the Contract Documents. During fabrication and prior to painting, holes shall be drilled and tapped in the flanges at the locations shown in the Plans. Drilling and tapping shall be 16 mm diameter galvanized headless bolts, ASTM A307, thread series UNC (coarse). Prior to painting, the holes shall be filled with a bolt to protect the threads. The bolts shall not be removed until after the posts are erected in the field and just prior to panel insertion.

Welding shall conform to the requirements of the SCM. Shop drawings shall be prepared, approved and distributed in accordance with the provisions of the SCM, except that the term "D.C.E.S." shall be interpreted as the Engineer".

B. Surface preparation shall consist of cleaning galvanized steel surfaces in accordance with the methods listed hereon. The cleaned surfaces shall be approved by the Engineer or his appointed inspector prior to any painting. Exposed bare steel surfaces on galvanized material shall be touched up in accordance with ASTM A 780 prior to applying paint system.

All foreign matter such as oil, grease, and dirt shall be cleaned from the surface using a bio-degradable cleaner (i.e., Carboline #3 Cleaner or Dev-Prep 88) in accordance with the Steel Structures Painting Council Surface Preparation No. 1 (SSPC-SP1) “Solvent Cleaning”. All surfaces shall then be brush blasted in accordance with SSPC-SP7 “Brush-Off Blast Cleaning” using a fine abrasive at nozzle pressures not to exceed 60 psi. The abrasive blast media shall be non-ferrous and softer than zinc. A uniform anchor profile of 25 to 38 um shall be achieved. Brush blasting must be performed to 100% of the surface area being coated.

All surfaces brush blasted must be primed the same day.

C. Painting

Note that all painting will be done in the shop. Painting shall be done in accordance with Special Note "Preparation and Painting of Steel Surfaces" in the Proposal. The color of the finish or third coat shall be conform to that indicated on the plans. Viewing shall be under North Standard Daylight. The finish coat shall be applied in the shop.

A sample of the steel painting system shall be submitted for approval. A steel plate (ASTM-A36) 300 mm wide, 600 mm long and 10 mm thick shall be completely painted on both sides with the primer coat followed by the intermediate coat of paint for 450 mm of the length, both sides, followed by the finished coat of paint for 300 mm of the length, both sides.

Before beginning construction, the Contractor shall submit shop drawings showing fabrication details; and handling, transportations, and construction procedures for all wall elements including connections.

1. Handling, storage, transportation

   Employ positive means to protect panel edges from damage. Load and ship panels with care as indicated or as per manufacturer's recommendation.

   Lift panels so as to minimize strain, distortion or impact loads.

2. Erection

   Construct structure mounted posts and connections as indicated on the design contract drawings and approved shop drawings.

   After the posts are set in their final, truly vertical, position the space between the base plate and the top of the slab shall be filled with a mortar leveling pad meeting the requirements of Section 701-05, Concrete Grouting Material. The requirements of Subsection 568-3.02 shall apply.

   Install noise barrier wall as indicated as shown on approved shop drawings, and in accordance with the manufacturer's recommendations.

   Install neoprene pad between noise barrier and base plates of the steel posts. The pad should compress sufficiently to provide uniform bearing for the full length of the panel.

   Lift panels by the two (2) 19 mm diameter lifting eyes located in the panel. After installation, the lifting eyes shall be removed and replaced with 19 mm diameter x 19 mm galvanized bolt, and washer to seal insert.

   Once in place, panels shall be field drilled, at holes in post, to secure 16 mm A325 M diameter bolts through wire rope loops. (Passive restraint system) as indicated.

   Use a polyurethane sealant to seal the Sound Zero Panel or approved equal to the post flange. Sealant is only required on one side of panel.

   After final placement, exposed panel faces shall have the anti-graffiti coating applied where indicated on the Plans and in accordance with the manufacturer's surface preparation instructions and recommendations.

   Minor defect repairs such as touch-up field painting shall be made as ordered by the Engineer after final placement.

   Repair and repair procedures require approval by the Engineer.

3. Technical Assistance:

   Have a company representative present, full time, at the project site during erection procedures of the noise barriers to assist the fabricator, contractor, and Engineer. Provide a technical representative to assist in the event unusual problems or special circumstances arise.

Manufacturer's Representative. The manufacturer of the lightweight aggregate shall supply a service representative at the site for the first two days of lightweight concrete placement operations. The representative shall be responsible to assist the Contractor and the Engineer in the control of lightweight concrete mixing and placement operations.

A technical report shall be submitted to the Engineer, by the lightweight aggregate manufacturer regarding any observations or test results related to the concrete practices at the work site.

CERTIFICATION

The Contractor shall submit a certificate stating his compliance with these Specifications and the Plans.

METHOD OF MEASUREMENT

This work will be measured as the number of square meters of NOISE BARRIER SYSTEM (STRUCTURES) satisfactorily furnished and installed.

The Noise Barrier System will be measured by the total number of square meters of the noise barrier measured from the top to the bottom of the wall panels and from center to center of posts. Only one side of the barrier will be measured for payment.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

No additional payment will be made for the required samples.

Progress payments for this work will be made as follows:

1. Twenty (20) percent of the quantity will be paid for after all foundations are in place to the satisfaction of the Engineer.

2. Twenty (20) percent of the quantity will be paid for after all posts have been erected to the satisfaction of the Engineer.

3. The remainder of the quantity will be paid for after all panels have been erected to the satisfaction of the Engineer.

SPECIAL NOTE

PREPARATION AND PAINTING OF BARE STEEL SURFACES

This note applies only to the preparation and painting of bare steel surfaces. It does not apply to structural steel surfaces cleaned and painted under the 18570 series of pay items.

Atmospheric Conditions

No surface preparation (cleaning) or paint application shall be performed unless all the following conditions are met:

a. The receiving surface shall be clean and absolutely dry.

b. The receiving surface temperature and ambient air temperature shall be as recommended by the paint manufacturer, except that in no case shall cleaning or painting work be performed when surface and ambient temperatures are less then 4.5°C or greater than 38°C.

c. The paint material temperature shall be as recommended by the paint manufacturer, except that in no case shall paint be applied when the paint material temperature is less than 4.5°C.

d. The receiving surface temperature shall be at least 3°C above the dew point.

e. The relative humidity shall be less than 85%.

Preparation of Bare Steel Surfaces

All surfaces to be painted shall be cleaned to bare steel in accordance with SSPC-SP6, Commercial Blast Cleaning. Abrasive materials for blast cleaning shall be selected by the Contractor. The material shall leave the cleaned steel surface roughened to a degree suitable for the paint system that will be applied.

Before blast cleaning begins, visible deposits of oil, grease, dirt, salt, or other contaminants shall be removed by the methods specified in SSPC-SP1, Solvent Cleaning.

The area cleaned shall be limited to that which can be cleaned and prime coated within a 24 hour period provided the condition known as flash rusting does not occur. Cleaned areas shall be approved by the Engineer or Inspector prior to priming.

Paint and Thinner

Paint and thinner shall be selected from the Department's Approved List, "PAINTS FOR STRUCTURAL STEEL, A. Primer Paint and Thinners, B. Intermediate Paint and Thinners, and C. Finish Paint and Thinners." No substitutions will be allowed.

All primer, intermediate, and finish coats of paint used on this contract shall be produced by the same manufacturer.

Each single paint (epoxy primer, epoxy intermediate coat and urethane finish coat) shall be a different color. The color of the primer and intermediate coat will be the Contractor's option. However, they shall contrast with the underlying substrate and/or previously applied paints. The intermediate (or primer) coat

color shall be such that it can be completely hidden by a single coat of finish paint applied at the minimum specified dry film thickness.

The color of the finish coat shall be as specified in the contract documents.

Basis of Acceptance.

Acceptance of paint and thinner material will be based on the appearance of the manufacturer's name, and the product name, on the Department's Approved List.

Only paint and thinner furnished in new, unopened containers shall be used.

Containers of paint shall be labeled with the manufacturer's name, product name, component part, batch number, date of manufacture and shelf life date. Paint in containers having expired shelf life dates shall be immediately removed and not used.

Containers of thinner shall be labeled with the manufacturer's name and the product name. If an approved generic thinner is supplied it shall be clearly identified as reagent grade.

Painting

Bare steel surfaces shall be painted with a three coat system consisting of epoxy primer, epoxy intermediate coat, and a urethane finish coat. Galvanized surfaces shall be painted with a two-coat system consisting of epoxy primer and a urethane finish coat.

At least 5 working days prior to the start of work the Contractor shall provide the Engineer with one copy of the paint manufacturer's current technical data sheets for the paint furnished.

Instructions, suggestions and precautions contained in the data sheets shall be followed to the extent that they do not contradict the provisions of this special note.

At the time of paint application the receiving surface shall be free of all contaminants such as petroleum products, sand blasting aggregates and other debris generated by the cleaning operations, dirt, dust and moisture. Should an exudate haze form on the receiving surface it shall be washed off with mineral spirits or detergent and water. All cleaning required on the receiving surface to remove these or other contaminants shall be done in accordance with SSPC-SP1 Solvent Cleaning.

Paint shall be proportioned and thoroughly mixed with mechanical mixers in accordance with the paint manufacturer's recommendations.

Thinning of paint will be allowed only with the express permission of the Engineer. All thinning shall be done in strict accordance with manufacturer's instructions. Only the type and quantity of thinner recommended by the manufacturer shall be used.

Paint may be applied by brush, roller or airless spray methods unless otherwise recommended by the paint manufacturer. The requirements and restrictions of Standard Specification Subsection 740-01 apply.

No coat of paint shall be applied until the previous coat has cured in accordance with the manufacturer's instructions and has been approved by the Engineer.

Individual coats shall be applied in sufficient quantity to produce the following minimum dry film thickness:

Primer	Intermediate	Finish
0.102 mm	0.102 mm	0.076 mm

The dry film thickness shall be determined in accordance with SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Paint Thickness with Magnetic Gages. Dry film thickness shall be measured by fixed probe magnetic gages. The Contractor shall supply all the equipment required by Standard Specification Subsection 740-01 as well as two fixed probe magnetic gages - Positector, or equal as approved by the Director, Materials Bureau. No work shall be done until the required equipment is supplied.

Areas failing to meet the specified minimum dry film thickness shall be over coated with the same type of paint to produce at least the total dry film thickness required. Paint applied containing unauthorized thinners, paint applied to contaminated surfaces and paint applied contrary to this special note shall result in recleaning and repainting the surface. The work of recleaning, repainting or overcoating, if required shall be done by the Contractor to the satisfaction of the Engineer at no additional cost to the State.

The intermediate and finish paint shall be applied to the receiving surface within 30 days of application of the previous coating, or within the manufacturer's recoat or finish coat schedule recommendation, whichever is less.

Paint in storage shall be protected from damage and maintained between 4.5°C and 32.5°C. Paint not used before the expiration date shown on the containers shall be immediately removed and not used.

After erection, all areas where paint has become damaged or deteriorated shall be thoroughly cleaned and "touched-up" or repainted with the appropriate number of coats as directed by and to the satisfaction of the Engineer.