SECTION 534
NOISE BARRIER WALL

534-1 Description.

Furnish and install noise barrier walls.

534-2 Materials.

534-2.1 Metal Noise Barrier Walls: Construct metal noise barrier wall, including all material, labor, and equipment required, in accordance with the Contract Documents and the following:

(1) Panels: Provide steel facing material of cold-formed steel meeting ASTM A 653 [ASTM A 653 M], Grade B. Provide panels having a minimum covering width of 12 inches [300 mm]. To prevent vibration and noise leaks, provide each panel with a male-female rib providing a friction interlock connection with adjacent panels, or otherwise adequately join panels in accordance with the manufacturer's specifications. Ensure that the friction interlock connection provides sufficient connection strength to support its own weight without using fasteners when connecting to another panel and being in the vertical or horizontal positions. Galvanize panels in accordance with ASTM A 653 [ASTM A 653M], Class Z275 [G-90]. Fabricate the wall to the shape shown on the plans or in approved shop drawings.

(2) Protective Color Coating: Apply a coating of polyvinyl fluoride or polyvinylidene fluoride film with a minimum thickness of 1 mil. [25 μm] to both sides of all panels and flashings. Ensure that a qualified laminator factory applies the coating film to a cleaned and treated galvanized steel surface as per the manufacturer's specifications. Match the Federal Standard Color specified in the plans for the color of the coating. Only use caulking that is color pigmented to match the color of walls and meets Federal Specification TT-S-00230-C or TT-S-1657.

(3) Posts: Ensure that posts are fabricated from hot-rolled steel meeting ASTM A 36 [ASTM A 36M] and hot-dip galvanized in accordance with ASTM A 123, except that the coating weight will be a total of 2 ounces [600 g/m^2], minimum on all sides.

(4) Steel Flashing and Caps: Only provide flashings, caps, and bracing of the same material as the panels. For flashings and caps, meet the same protective coating requirements as the panels.

(5) Self-Drilling Screws: Only use self-drilling screws that are cadmium coated in accordance with ASTM B 766.

(6) Nuts and Bolts: Only use nuts and bolts of the size shown in the plans or on approved shop drawings and galvanized as per ASTM B 663.

Before proceeding with the manufacture or assembly of the wall, submit shop drawings covering the complete system, including structural supports and complete erection requirements.

534-2.2 Concrete Noise Barrier Walls: Construct concrete noise barrier wall, including all material, labor, and equipment required, in accordance with the Contract Documents and the following:

(1) Precast Concrete:

a. General: Fabricate, transport, and erect panels in such a manner as to prevent damage thereto.

Fabricate the panels in accordance with Section 400, except as modified below, and in the plans:

1. Use forms that are true to the dimensions shown in the plans.
2. Place the concrete in one continuous lift resulting in no cold joints.
3. Provide all accessories, materials, and methods which are not specifically specified in the Contract Documents, but which are essential for installation or construction of the panels commensurate with the best standard practice of the industry, subject to the approval of the Engineer, without additional compensation.

Apply the surface treatment specified in the plans to both traffic and residential faces of the walls.

b. Materials: Furnish the Engineer with certification that the panels supplied for the construction of the wall meet the concrete class and strength requirements specified in the plans.

c. Construction:

1. Fill any and all holes on the panels resulting from their fabrication or installation with an approved mortar grout.

2. Cut all exposed bars, etc., used in lifting or assembling the panels flush with the surface. Then clean the bars, and coat the opening with an approved epoxy.

3. Paint all exposed metal fasteners in the finished work with an approved galvanized paint.

4. Do not use panels damaged by improper storing or handling.

(2) Cast-in-Place Concrete:

a. General: Construct the wall in accordance with the Contract Documents.

b. Materials:

1. Provide concrete of the class specified in the plans.

2. Provide reinforcing steel of deformed bars meeting the requirements of ASTM A 615, Grade 60 [ASTM A 615 M, Grade 400].

3. Use anchor bolts made of steel meeting the requirements of ASTM A 307 and galvanized in accordance with ASTM A 153. Use nuts and washers of steel meeting the requirements of ASTM A 325 [ASTM A 325M] and galvanized in accordance with ASTM A 153.

534-2.3 Wood Noise Barrier Walls: Construct wood noise barrier wall in accordance with the plans or as directed by the Engineer.

(1) Wood Planking: Provide planks and/or battens of Southern Pine or Douglas Fir, No. 2 grade or better. Use only planks with no holes and with tight knots. Do not intermix the species of wood.

Consider all specified thickness and width dimensions of solid sawn wood for timber facing material to be actual dimensions.

Joint facing boards with a wedge-shaped cut on their edge. Stamp facing lumber and battens with the appropriate grade mark.

(2) Plywood Panels: Provide sheeting of Douglas Fir or Southern Pine, exterior grade, which meets the requirements of the American Institute of Timber Construction (AITC).

Use glue meeting the requirements of ASTM D 2559 to fabricate the plywood panels.

(3) Sealant: Use a caulking sealant having a life expectancy of 20 years and meeting the requirements of Federal Specification TT-S-230. Ensure that the finished color of the sealant is similar to the wood stain as approved by the Engineer.

(4) Preservative Treatment (Water-Borne):

a. Dry all lumber materials, other than wood posts, to 19% moisture content or less prior to treatment.

b. Use the same preservative to treat bolt holes, saw cuts, etc., (if any), and for additional dressing deemed necessary by the Engineer.

c. Kiln-dry all wood members, except posts, to a moisture content of 15% or less after preservative treatment.

d. After completion of the preservative treatment, protect all lumber materials from increases in moisture content until incorporating them into the wall as required by AITC-111-65.

e. Treat all timber materials with Chromated Copper Arsenate (CCA) or Pentachlorophenol in accordance with Section 955.

534-2.4 Posts: Use Class I concrete for backfilling the post holes.

Provide wood posts of Douglas Fir or Southern Pine meeting the requirements of the AITC and treated as per 534-2.3(4)e.

Use structural steel posts fabricated from steel meeting the requirements of ASTM A 36 [ASTM A 36M] and galvanized in accordance with ASTM A 123 [ASTM A 123M].

Use concrete for reinforced concrete posts of the class shown in the plans. Form the concrete to the dimensions shown in the plans. Provide reinforcing steel of deformed bars meeting the requirements of 931-1.1.

534-3 Construction Methods.

A. Prior to beginning earthwork on the project, stake the wall location in the field, and establish the final groundline elevations at the barrier walls. Use these elevations to develop the shop plans, including a complete elevation view of each wall indicating top and bottom elevations as well as the roadway grade. Protect the final ground elevations established in the field for the duration of the project, and do not adjust without prior approval of the Engineer. Keep to a minimum the clearing and grubbing, and trimming of trees as necessary to construct the walls.

B. Do not mix wall types or colors at any one site. Install the walls in accordance with the plans, and in accordance with shop drawings submitted to and approved by the Engineer. Secure joints and connections in such a manner as to be structurally sound with no visible openings for sound transmission. Ensure metal walls do not produce a secondary source of noise transmission due to vibration.

C. Repair marred, chipped, scratched, or spalled areas of walls at no expense to the Department in accordance with the manufacturer's recommendations or at the Engineer's direction.

D. The Contractor may substitute welded for fixed bolt connections or vice versa on metal walls, where applicable, provided he submits load calculations for the specific modified connection and uses a minimum safety factor of 3.0.

E. Place trench backfill for wall construction in accordance with 125-8. Use select materials for the trench backfill.

If, in the opinion of the Engineer, the trench is too narrow to compact, backfill the trench excavation with concrete grout to the satisfaction of the Engineer at no expense to the Department.

F. Dispose of all excess excavation in a manner satisfactory to the Engineer.

G. Keep right-of-way fence that is scheduled to be salvaged in place until completing the wall or, in the opinion of the Engineer, as long as possible.

H. Place 4 mil [100 μm] polyethylene sheeting between the timber walls and the earth.

I. Stain wood and concrete walls the color shown in the plans.

J. After erecting the wall, leave the disturbed area in a finished condition at the direction of the Engineer, and grass or sod the area as indicated in the plans.

K. Tolerances:

(1) Ensure that vertical alignment for walls and posts is:

1/2 inch [13 mm] for wall heights to 10 feet [3 m];
1 inch [25 mm] for wall heights 10+ feet [3 m plus] to 20 feet [6 m]; and,
1 1/2 inches [38 mm] for wall heights greater than 20 feet [6 m].

(2) Ensure that horizontal alignment for walls is in reasonably close alignment to that shown in the plans so as to prevent panels from slipping out of the post joints.

(3) Set post spacings ±1/2 inch [13 mm] of their intended location.

L. When building noise walls on top of earth berms, construct the berms of fill material compacted to 95% of the maximum density as determined by AASHTO T 99.

M. Provide the concrete wall (Precast or Cast-in-Place) with a uniform color, pattern, and texture.

N. Design the walls to be capable of withstanding a wind loading as required by the AASHTO Guide Specifications for Structural Design of Sound Barriers with a minimum of 110 mph [175 km/h] of wind velocity for exposures B2, C, or D.

O. Ensure that the walls effect and provide for a 20 decibel sound transmission loss at 500 Hz.

534-4 Test Wall.

Erect a test wall section not less than 50 feet [15.0 m] in length before starting general wall construction at the project site. The Engineer will use the erection of the test wall to determine if the Contractor's methods and equipment are sufficient to produce a noise barrier wall that meets the requirements of the Contract Documents. The Contractor may revise his methods and equipment as necessary, at any time during the positioning of the test wall, in order to satisfactorily meet all Contract requirements. Build the test wall at a permanent wall location, as directed by the Engineer. If the test wall does not meet the construction tolerances, remove and dispose of it at no expense to the Department. Include the cost of the test wall in the cost of the noise barrier wall.

534-5 Method of Measurement.

The quantity to be paid for will be the area, in square feet [square meters], measured in place, completed and accepted.

534-6 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section, including furnishing all materials, labor, and equipment necessary to construct the noise barrier walls.

Payment will be made under:

Item No. 534-72-	Noise Barrier Wall - per square foot.
Item No. 2534-72-	Noise Barrier Wall - per square meter.