CONSTRUCTION SPECIFICATION FOR NOISE BARRIER SYSTEMS

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760.01 SCOPE

This specification covers the requirements for the construction of noise barrier systems.

760.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 206	Grading
OPSS 501	Compacting
OPSS 510	Removal
OPSS 609	Grounding
OPSS 740	Concrete Barrier
OPSS 902	Excavating and Backfilling - Structures
OPSS 903	Deep Foundations
OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete
OPSS 906	Structural Steel for Bridges

Ontario Provincial Standard Specifications, Material

OPSS 1010	Aggregate - Base, Subbase, Select Subgrade, and Backfill Material
OPSS 1350	Concrete - Materials and Production
OPSS 1355	Precast Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

Designated Sources of Materials (DSM)

CSA Standards

S6:25 Canadian Highway Bridge Design Code

ASTM International

A123/A123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A780/A780M-20	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
B209-21a	Aluminum and Aluminum-Alloy Sheet and Plate

760.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Bottom Panel means the lowest precast concrete component of the noise barrier system that the reflective or absorptive noise barrier panel is placed on.

Element mean an individual precast concrete unit.

Manufacturer means the party that supplies and/or specifies the design, materials, and components for the proprietary noise barrier system selected by the Contractor.

Noise Barrier System means all the components of the noise barrier system that includes the upper reflective or absorptive noise barrier panel, the precast concrete bottom panel, the traffic barrier and the cast-in-place concrete foundations. Noise barrier on structures includes only the upper reflective or absorptive noise barrier panel. Noise barrier that is not on structures includes either a precast concrete bottom panel or a traffic barrier.

Panel means the upper reflective or absorptive component of the noise barrier system, which can be made of concrete, steel, vinyl, aluminum or other materials such as cement-treated wood chips.

Traffic Barrier means a barrier placed adjacent to a roadway to protect traffic from hazardous objects either fixed or moving (other traffic). Barriers placed in a median are referred to as median barriers and may be placed in flush, raised or depressed medians.

760.04 DESIGN AND SUBMISSION REQUIREMENTS

760.04.01 Design Requirements

760.04.01.01 General

The noise barrier system design shall be as specified in the Contract Documents and according to the manufacturer's specifications.

760.04.01.02 Footings

760.04.01.02.01 General

Footings shall be designed according to CSA S6 and based on the soil design parameters specified in the Contract Documents.

760.04.01.02.02 Footings in Earth

When footings are located on or adjacent to a sloping ground, potential reduction of the stability and geotechnical resistance, lateral resistance and frost protection cover shall be considered during design and shall be reflected in the Working Drawings.

760.04.01.02.03 Footing in Rock

When rock is encountered above the design elevation of the underside of footings, the footings shall be redesigned in consideration of the rock. The footings can be redesigned with rock properties supplied by the Owner. The revised design shall be submitted to the Contract Administrator prior to proceeding with the work.

760.04.02 Submission Requirements

760.04.02.01 Noise Barrier System Working Drawings

Working Drawings, including manufacturer's installation instructions and other applicable supporting documentation, shall be submitted to the Contract Administrator at least 4 weeks prior to commencement of the construction. The Working Drawings shall be signed and sealed by a design Engineer and a design-checking Engineer.

The Working Drawings shall include as a minimum the following information:

a) Element details including all projections, recesses, notches, openings, blockouts, and other pertinent details;

b) Plan and elevation including:

   i. Post height;
   ii. Top and bottom of foundation elevation;
   iii. Quantity, size, and type of panels;
   iv. Location of doors, fire hose access, etc.

c) All affected utilities, drainage and protective measures that will be employed;

d) Details at obstructions, and connections to other structures, when specified in the Contract Documents;

e) Transition details from/to standard roadside barrier to proprietary noise/traffic barrier systems.

f) Steel reinforcement schedule;

g) Installation details including lifting point details and locations, temporary shoring, supports and guys.

h) Sequence for installation and removal of temporary and permanent works;

i) Stripping strength for formwork removal and requirements for handling of components immediately after stripping;

j) Soil and rock design parameters for the foundation design;

k) Foundation dimensions including but not limited to diameter, depth, length, width, thickness;

l) Foundation construction work plan:

   i. Construction sequence
   ii. Proposed suitable equipment for the anticipated site conditions

m) Details of:

   i. Footing/ caisson excavation
   ii. Protection of foundation base.
   iii. Protection of caisson shaft from collapsing
   iv. Removal of loose material from the foundation base.
   v. Dewatering if required, and,
   vi. Concrete placement.

760.05 MATERIALS

760.05.01 General

All components for noise barrier systems shall be according to the manufacturer's specifications and as specified in the Contract Documents.

All materials for the selected noise barrier shall be according to the approved DSM submission for that noise barrier.

760.05.02 Caisson Piles

Caisson piles shall be according to OPSS 903.

760.05.03 Concrete

Concrete for footings and all other cast-in-place components shall be according to OPSS 1350 with the following addition:

a) The minimum 28-Day compressive strength shall be 30 MPa, unless otherwise specified in the Contract Documents.

760.05.04 Granular Material

Granular material shall be according to OPSS 1010.

760.05.05 Mortar

Mortar shall be from the Ministry's List of Concrete Patching Materials, and shall be non-shrink and suitable for the application. The list shall be obtained from the Contract Administrator.

760.05.06 Posts

Steel posts and components shall be hot dip galvanized after fabrication according to ASTM A123. Galvanized surfaces that are damaged shall be cleaned and painted with a zinc-rich paint according to ASTM A780.

Zinc-rich touch-up paint shall be according to the ministry's DSM.

760.05.07 Precast Concrete

Precast concrete noise barriers shall be according to OPSS 1355 with the following addition:

a) The minimum 28-Day compressive strength shall be 30 MPa, or greater when specified in the Contract Documents.

Traffic barrier used as part of the noise barrier system, shall be according to the requirements for concrete barrier specified in OPSS 740.

760.05.08 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

760.07 CONSTRUCTION

760.07.01 General

Noise barrier systems shall be installed according to manufacturer's specifications at locations specified in the Contract Documents.

760.07.02 Connection to Existing Fence

When sections of an existing parallel or cross fence are to be removed or replaced or both with a noise barrier system, a sufficient length of existing fence shall be maintained in good condition to adequately allow for connection to a new post at locations shown in the Contract Documents.

Removal of fence shall be according to OPSS 510.

760.07.03 Underground Utility and Drainage Crossings

Reduced post spacing shall be permitted according to the manufacturer's specifications to avoid placing posts on top of underground utilities and drainage crossings.

760.07.04 Existing Overhead High Voltage Lines

When the potential of arcing exists due to the close proximity of existing overhead high voltage lines, steel noise barrier panels and posts shall be grounded according to OPSS 609.

760.07.05 Grading

Grading and berm construction associated with the barrier installation shall be completed to within 25 mm below the bottom of the noise barrier system prior to constructing the barrier footings. Grading up to 300 mm shall be part of installation of noise barrier system.

All grading shall be according to OPSS 206.

Earth and granular material shall be compacted according to OPSS 501.

Tree pruning and removal shall be kept to a minimum and shall be subject to the approval of the Contract Administrator prior to the commencement of any pruning and removal.

760.07.06 Footings

Concrete for cast-in-place concrete footings shall be according to OPSS 904. Steel reinforcement for cast-in-place concrete footings shall be placed according to OPSS 905.

Prior to the installation of panels, the Contractor shall demonstrate that the concrete in the footings has reached the specified 28-Day compressive strength, by preparing, curing, and transporting early strength cylinders according to the Testing for Early Strength clause of OPSS 904.

Footings, except caissons, shall be placed below the frost depth. The top of the footing shall be kept a minimum of 150 mm below the final grade level, and a 300 mm space shall be provided around the footing to be backfilled with granular material according to OPSS 902, after placement of the footing.

The granular materials around the footing shall be compacted according to OPSS 501, to at least 95% standard proctor maximum dry density.

The top of all footings shall be shaped to provide for full horizontal seating of panels and the remaining surface area shall be sloped away from the post to shed water. Stepped footings shall be constructed to suit grade changes.

All excavations into rock shall be backfilled entirely with concrete according to OPSS 904. Excavation above the top of rock shall be formed to the required dimensions and the remainder of the excavation backfilled with granular material according to OPSS 902.

760.07.07 Caisson Piles

Caisson piles shall be placed according to OPSS 903.

760.07.08 Posts

Structural steel posts shall be according to OPSS 906. Intermittent welding shall not be permitted.

The space between the top of the footing and underside of post base plate shall be filled with mortar. The mortar shall be mixed, handled and cured according to the manufacturer's instructions.

Tolerance for post plumb shall be according to the manufacturer's specifications.

760.07.09 Installation

760.07.09.01 General

Bottom panels, traffic barrier and panels shall be constructed to the line and grades as specified in the Contract Documents with a tolerance of ±10 mm.

When changes in horizontal alignment are greater than 2° or when changes in vertical alignment are greater than 2% between adjacent elements, the ends of the elements shall be manufactured with the appropriate skewed end detail. Elements required to match ground profiles with grades in excess of 2% shall be manufactured with skewed ends to match the vertical post detail. The space between each element on the traffic side surface shall not exceed 25 mm at the base of the traffic barrier. The difference in elevation between adjacent elements shall not exceed 25 mm. Any levelling or plumbing of elements shall be done according to the manufacturer's specifications.

760.07.09.02 Bottom Panels

Immediately prior to installation of bottom panels, the top of the footings shall be clear of debris, loose material, ice, snow, and water.

Bottom panels shall be positioned to have complete contact with the post flange along the traffic side of the elements.

760.07.09.03 Traffic Barrier

Granular base for the traffic barrier shall be placed in a manner to ensure that there are no voids between the bottom surface of traffic barrier and the granular material and that the elements are set to the specified line and grades.

760.07.09.04 Panels

The top of the bottom panels or traffic barrier elements shall be clear of any debris, loose material, ice, snow, or water prior to installing the panels.

All panels shall be cleaned of any oils, dirt, and debris.

Panels shall be installed horizontally and stepped when necessary to match the elevation profile specified on the Working Drawings. Changes in horizontal direction shall be made using special arrangements of the posts according to the manufacturer's specifications.

The point of contact between the top of the bottom panel or traffic barrier and the bottom of the panels shall be sealed according to manufacturer's specifications.

There shall be no visible gaps between any panels or between the panels and the bottom panel or traffic barrier after completion of the installation.

760.07.10 Noise Barrier Access Openings

Openings, frames, doors, and hardware for noise barrier access shall be supplied and installed according to the Working Drawings and the manufacturer's installation instructions at the locations specified in the Contract Documents and shall be of the types specified in the Contract Documents.

Openings shall be cut a minimum distance of 1,000 mm from the centerline of the noise barrier post to the centerline of the opening.

The centre of fire hose access openings shall be located within the range of 1,300 to 1,500 mm measured from the finished ground surface.

Standard opening sizes for fire hose access and person door access are shown in Table 1. Dimensions and details for all other access opening shall be as specified in the Contract Documents. The openings shall meet the specified dimensions and shall be centred between adjacent posts.

Each noise barrier access opening shall be fitted with a hinged door that opens away from the roadway to a minimum opening angle of 110º.

When doors are in the closed position, there shall be no impact to the acoustical characteristics of the noise barrier system. All gaps between openings and frames shall be sealed to ensure that there are no gaps.

760.07.11 Noise Barriers on Structures

Noise barrier system shall be attached to the structure as specified in the Contract Documents.

Flashing shall be installed and sealed in a manner to prevent water from ponding on the structure and shall be installed according to the manufacturer's specifications.

760.07.12 Marking

Identification plates, provided by the manufacturer, shall be attached to the completed noise barrier system at the following intervals:

a) At the start and end of noise barrier system.

b) At a maximum interval of 300 m.

The identification plate shall be located within 300 mm of a terminal post with the top of the plate located approximately 1.2 m above the ground. The maximum dimensions of the plate shall be 200 by 200 mm. The plate shall be made from 0.81 mm thick anodized aluminum sheet according to ASTM B209 series 1100 or 5005-H34.

Each plate shall be engraved with the following information:

a) Contract number.

b) Name of manufacturer of noise barrier system.

c) Name of Subcontractor that installed the noise barrier system.

d) Date of completed installation (i.e., yyyy-mm).

The height of the letters and numerals shall be within the range of 6 to 32 mm.

760.07.13 Quality Control

760.07.13.01 Inspection before Installation of Noise Barrier Panels

A Request to Proceed shall be submitted to the Contract Administrator after the construction of the noise barrier footings and posts and prior to the installation of the panels.

The installation of the panels shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

760.07.13.02 Inspection after Installation of Noise Barrier System

A Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the installation of the noise barrier system.

760.07.14 Sampling of Steel Reinforcement

When requested by the Contract Administrator, samples of steel reinforcement shall be provided to the Owner according to OPSS 905.

760.07.15 Site Restoration

After noise barrier system installation, the site shall be cleaned and trimmed and the ground restored to a neat condition.

760.07.16 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

760.08 QUALITY ASSURANCE

760.08.01 Acceptance

The acceptance of noise barrier system shall be according to the requirements of this specification and the Contract Documents. Noise barrier system components not meeting the requirements of the Contract Documents shall be deemed unacceptable and shall not be included in the Work.

760.09 MEASUREMENT FOR PAYMENT

760.09.01 Actual Measurement

760.09.01.01 Noise Barrier System
Noise Barrier System Including Precast Noise/Traffic Barrier
Noise Barrier System on Structures

Measurement of noise barrier system shall be along the horizontal length in metres of the specified height. Transitions between barrier heights shall form part of the higher barrier and terminations shall form part of the adjoining barrier.

760.09.01.02 Noise Barrier Access

For measurement purposes, a count shall be made of the number of accesses installed.

760.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the components in the clauses under Actual Measurement.

760.10 BASIS OF PAYMENT

760.10.01 *"height"* Noise Barrier System - Item
***"height"* Noise Barrier System Including Precast Noise/Traffic Barrier - Item**
***"height"* Noise Barrier System on Structures - Item**
Noise Barrier Access - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work, subject to payment adjustments according to OPSS 1355.

Grading up to 300 mm shall be included as part of the noise barrier system item. For earth grading requirements greater than 300 mm, the full grading is provided under the earth excavation item.

At the discretion of the Contract Administrator, if unidentified difficult soil conditions (i.e., rock, shale, or unstable earth) are encountered above the design footing depths, work necessary to complete the design requirements such as caissons, dewatering, additional concrete, or different augering equipment, shall be paid for as Changes in the Work.

760.10.02 Removals and Replacements

Cost associated with any required removals and replacements of defective workmanship or materials shall be the Contractor's responsibility at no cost to the Owner.

TABLE 1
Noise Barrier Access Standard Opening Sizes

Type of Door / Opening	Opening Size (W mm x H mm)
Fire Hose Access	254 x 254
Person Door Access	915 x 2438