CONSTRUCTION SPECIFICATION FOR NOISE BARRIER SYSTEMS

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760.01 SCOPE

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

760.01.01 Specification Significance and Use

This specification has been developed for use in municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

760.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

760.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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 904	Concrete Structures
OPSS 906	Structural Steel for Bridges

Ontario Provincial Standard Specifications, Material

OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

CSA Standards

S6-06	Canadian Highway Bridge Design Code

ASTM International

A 123/A 123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 780/ A 780M-09(2015)	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
B 209-14	Aluminum and Aluminum-Alloy Sheet and Plate

760.03 DEFINITIONS

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

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

760.04 DESIGN AND SUBMISSION REQUIREMENTS

760.04.01 Design Requirements

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

760.04.01.01 Footings

760.04.01.01.01 General

Depth of footings shall be according to CAN/CSA S6 and based on the soil design parameters and wind load as specified in the Contract Documents.

760.04.01.01.02 Footings in Earth

When footings are to be installed on or within 1 m from a downward slope of 3H:1V or steeper, the Working Drawings shall reflect this and shall note an increase in embedment depth of a minimum of 0.5 m greater than the requirements specified in CAN/CSA S6.

760.04.01.01.03 Footing in Rock

When rock is encountered within the specified excavation depth for footings in earth, the footing shall be designed and constructed according to the Footings in Earth clause based on soil properties and wind load as specified in the Contract Documents. Alternatively, the design depth into rock shall be designed based on rock properties provided by the Owner. The minimum design depth below final grade shall not be less than 1.5 m or to the frost depth, whichever is the greater.

760.04.02 Submission Requirements

760.04.02.01 Working Drawings

The Contractor shall submit 3 copies of Working Drawings for the noise barrier system to the Contract Administrator at least 4 weeks prior to the commencement of construction. The Working Drawings shall show full details of noise barrier related items, erection procedures and, if applicable, connections to structures. An Engineer's seal and signature shall be affixed on the Working Drawings verifying that the drawings are consistent with the Contract Documents.

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.

760.05.02 Granular Materials

Granular material shall be as specified in the Contract Documents.

760.05.03 Footings

Cast-in-place concrete in footings shall be according to OPSS 1350 with a nominal minimum 28-Day compressive strength of 30 MPa.

760.05.04 Steel Reinforcement

Steel reinforcement for the footings 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 Site Grading and Preparation

Grading and berm construction associated with the barrier installation shall be completed to within 25 mm below the bottom of the barrier 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 materials shall be compacted according to OPSS 501.

There shall be no visible gaps between any barrier panels or beneath the bottom panels after completion of the barrier.

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.

760.07.03 Footings

Concrete shall be according to OPSS 904.

Concrete for drilled footings shall be cast entirely against undisturbed soil.

For other footings, the footing shall be formed and the excavation shall be backfilled with granular materials and compacted to at least 95% standard Proctor maximum dry density.

When required, 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.

Concrete in the footings shall be cured to meet design strength as specified by the Engineer prior to the installation of noise barrier panels.

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

760.07.04 Posts

Structural steel posts shall be according to OPSS 906.

Steel posts and components shall be hot dip galvanized after fabrication according to ASTM A 123. Galvanized surfaces that are abraded shall be cleaned and painted with a zinc-rich paint according to ASTM A 780.

The top of footing and underside of post base plate shall be filled with non-shrink grout according to the manufacturer's specifications.

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

760.07.05 Panels

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.

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

760.07.06 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 so that water will not pond on the structure according to the manufacturer's specifications.

760.07.07 Precast Noise and Traffic Barriers

Precast noise or traffic barrier units or both 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 units occur, the ends of the units shall be manufactured with the appropriate skewed end detail. Units 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 unit on the traffic side surface shall not exceed 25 mm at the base of the traffic barrier. The difference in elevation between adjacent units shall not exceed 25 mm. Any levelling or plumbing of units shall be done according to the manufacturer's specifications.

Granular base for the precast noise or traffic barrier units or both shall be placed in a manner to ensure that there are no voids between the bottom surface of units and the granular material and that the units are set to the correct line and grades.

Precast noise or traffic barrier units or both shall be set according to the manufacturer's specifications. Top of footings shall be clear of foreign material, ice, snow, or water.

Precast noise or traffic barrier units or both shall be positioned to have complete contact with the post flange along the traffic side of the units.

Top of the noise or traffic barrier units or both shall be cleared of any foreign or loose material, ice, snow, or water prior to installing the noise barrier panels.

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

760.07.08 Noise Barrier Access Openings

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

Openings shall be cut a minimum distance of 1.0 m 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 1.3 to 1.5 m 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 types including, but not limited to electrical access, vehicle access, and hydraulic access are 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.

760.07.09 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, the Contractor shall ensure that a sufficient length of existing fence is maintained in good condition to adequately allow for connection to a new post at locations shown in the Contract Documents.

Removal of any fence shall be according to OPSS 510.

760.07.10 Underground Utility and Drainage Crossings

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

760.07.11 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.

760.07.12 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 B 209 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 Interim Inspection of Footings and Posts

During construction of the noise barrier footings and posts and prior to the installation of the noise barrier panels from the fabrication facility, the Contract Administrator shall conduct an inspection during the work to verify that the footings and posts have been constructed in general conformance with the Contract Documents and issue the Contractor written permission to proceed with the work.

760.07.14 Site Restoration

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

760.07.15 Management of Excess Material

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

760.08 QUALITY ASSURANCE

760.08.01 Construction

Noise barrier components damaged in transit or during placement shall be replaced by the Contractor at no cost to the Owner.

The Contractor shall install noise barrier materials that are visually uniform in appearance in terms of colour, pattern, and texture. Uniformity of appearance is subject to approval of the Contract Administrator. Noise barrier panels shall visually match adjacent panels. Inspection shall occur at a distance of approximately 15 metres from the noise barrier system.

Final inspection of the complete noise barrier system shall not be made until it has been installed.

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.

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 Additional Work.

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 units shown 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.

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.

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

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FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Noise barrier system design requirements should include the following: (760.04.01)

a) Acoustics

The noise barrier system shall be designed for one of the following acoustical characteristic:

i. Either sound absorptive or reflective
ii. Sound absorptive on the highway side
iii. Sound absorptive on the residential side
iv. Sound absorptive on both sides.

If more than one acoustical characteristic apply to this Contract for various sections, then each section shall be designed accordingly with clearly defined limits.

b) Height

The designer shall select an appropriate height according to the acoustical requirements, which shall not be more than 5 metres.

c) Aesthetics

The designer shall plan the number of colours and textures for the Contract. The designer shall also specify the patterns and proportions in which each is required. The exact colour, texture, and pattern for the noise barrier system shall be specified following the award of the Contract, but will be within the following parameters:

The number of colours adjacent to highway is _____;

in the proportion of: _____ _____ _____ _____

The number of textures is _____;

in the proportion of: _____ _____ _____ _____

The number of colours adjacent to residential property is _____;

in the proportion of: _____ _____ _____ _____

The number of textures is: _____;

in the proportion of: _____ _____ _____ _____

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Final colour selections shall be determined by the Contract Administrator at the point of manufacture from samples prepared by the manufacturer.

If only one colour and texture are to be used, the noise barrier shall be constructed using only one colour and texture, which shall be specified by the Contract Administrator following the award of the Contract. Final colour selection shall be determined at the point of manufacture from samples prepared by the manufacturer.

d) Noise Barrier Access

The designer should provide station and offset (Lt. or Rt.) locations for all required barrier access points and indicate the type of access opening required at each location. Opening sizes for fire hose access and person access are standard. Opening sizes for other types of access including, but not limited to electrical access, vehicle access, and hydraulic access are site specific and should be specified by location and opening size.

- Soil design parameters and wind loads for footings should include the following: (760.04.01.01.01)

a) Footings

The designer shall design the noise barrier system footings according to CAN/CSA S6 with the assistance of soil design parameters. The designer shall also provide the soil design parameters as per the example below.

Station to Station	Soil Design Parameter
<u>East Bound Lane</u> 17+320 to 17+790 (shoulder)	Ø = 28º
<u>West Bound Lanes</u> 17+100 to 17+600 (ROW) 17+600 to 17+720 (ROW) 17+700 to 18+050 (shoulder)	Ø = 28º Cu = 12 Kpa Ø = 28º

b) Wind Pressure

The wind pressure information shall be used from CAN/CSA S6 for the city where the project is located (e.g., 415 Pa for Hamilton area).

- Noise barrier system material requirements. (760.05.01)

- Granular material to be used. (760.05.02)

- Noise barrier system locations. (760.07.01)

- Attachment requirements for noise barrier system to structure. (760.07.06)

- Line and grade specifications for precast noise/traffic barrier units. (760.07.07)

- Noise barrier access opening requirements. (760.07.08)

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- Locations where noise barrier system connects to existing fence. (760.07.09)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.