THE REGIONAL MUNICIPALITY OF PEEL

STANDARD SPECIFICATION

FOR

CONCRETE NOISE BARRIER WALLS

July 2009

STANDARD SPECIFICATION
FOR
PRECAST CONCRETE NOISE BARRIER WALLS

PART 1: GENERAL

1.1 General

This specification shall be read in conjunction with other related Contract Document requirements including the General Conditions, Information for tenders and Special Provisions.

1.2 Scope

This Specification covers the requirements for materials, design, fabrication and construction of noise barrier wall systems utilizing precast concrete panels.

1.3 Definitions

Whenever used in this Specification, the following terms shall have meanings as defined herunder:

- *Municipality* shall mean the Municipal jurisdiction of the abutting road. Or in the case of a wall adjacent to a railway it shall mean the local Municipal jurisdiction:

- *Peel Noise Wall Technical Committee* shall mean the committee established by the Region of Peel, City of Mississauga and the City of Brampton for the purpose of developing, administering, and maintaining uniform standards and specifications applicable to the design and construction of noise barrier walls in all three Municipal jurisdictions.

- *Supplier* shall mean the manufacturer of the precast concrete wall components;

- *Project Proponent* shall mean Subdivision or Site Plan Developer obligated under a Development Agreement with the Municipality to construct a noise barrier wall on his property.

- *Engineer or Consulting Engineer* shall mean the Consulting Engineer or the Consulting Engineering firm engaged by the Supplier or Project Proponent to design and certify the precast concrete noise barrier wall. The Consulting Engineer shall have documented experience in the design and construction review of Structural Engineering Projects:

- *Contractor* shall mean the party undertaking the installation of the precast concrete noise barrier walls.

1.4 Reference Standards, Specifications and Codes

This Specification refers to the following Standards, Specifications and Codes:

CSA-A23.1-94:	Concrete Materials and Methods of Concrete Construction
CSA-A23.2-94:	Methods of Test for Concrete
CSA-A23.3-94:	Design of Concrete Structures
CSA-A23.4-94:	Precast Concrete – Materials and Construction
CSA-S16.1-94:	Limit States Design of Steel Structures
CSA-G40.21-91:	Structural Quality Steels
CSA-G164-92	Hot Dipped Galvanizing of Irregularity Shaped Articles:
Ontario Highway Bridge Design Code (OHBDC). 1991	
Ontario Building Code, 1990	
OPSS 1352:	Precast Concrete Barriers
OPSS 1442:	Epoxy Coated Steel Reinforcement for Concrete

1.5 Pre-Qualification of Suppliers

The supply of Precast concrete components will be limited only to Suppliers who are pre-qualified by the *Peel Noise Wall Technical Committee*. In order for the Supplier to be considered for pre-qualification, the Supplier shall submit to the Peel Noise Wall technical Committee the following documentation:

- The Supplier's name and address, including the manufacturing plant location(s);
- A resume of the Supplier's experience in manufacturing precast concrete wall panels and a listing of completed projects in the region of Peel;
- The trade name of the product:
- A general statement as to the composition of the product and method of production;
- Detailed Material Specifications;
- Quality control program detailing procedures for manufacture, inspection, testing, shipping and handling;
- A Report from an independent Testing Company signed and sealed by a Professional Engineer licensed by the Professional Engineers of Ontario and dated within six (6) months of the submission date, certifying that samples tested from a normal production lot compiled with the requirements specified in Section 2.2 of this Specification.

Upon review of the documentation as submitted, the *Peel Noise Wall Technical Committee* will pre-qualify the Supplier, or, if the documentation is considered not to be satisfactory the *Peel Noise Wall Technical Committee* will advise the Supplier of the deficiencies. Pre-qualification of the supplier does not imply subsequent acceptance of the product which shall be subject to project specific testing as outlined in Section 2.3 herein. Unless otherwise notified, Supplier's pre-qualification status will be renewed on an annual basis by the *Peel Noise Wall Committee*. If the Supplier's pre-qualified status is not renewed the supplier may re-apply for pre-qualification

1.6 Submittals

The following documents shall be submitted to the Municipality for approval for each noise barrier wall project:

(i) Shop drawings, signed and sealed by a Professional Engineer licensed by the Professional Engineers of Ontario (with documented experience in Structural Engineering Design), showing details of noise barrier wall components including materials specifications and reinforcing:

(ii) Structural drawings(s), signed and sealed by a Professional Engineer licensed by the Professional Engineers of Ontario (with documented experience in Structural Engineering Design), showing foundation entails and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.

(iii) Layout plan and wall elevations showing proposed colours and patterns.

Note: A Geotechnical Report on foundation conditions specific to the wall location including recommendations on soil bearing and lateral resistance will be made available to the Supplier.

1.7 Quality Assurance

Inspection and testing for quality assurance during manufacture and installation shall comply with the requirements specified in Section 2.3.2 and 3.2 herein.

1.8 Delivery, Handling, Storage and Protection

Handle, transport and store wall components to meet specified requirements of CSA Standard A23.4 and to prevent damage, soiling and staining.

2 PART 2: PRODUCTS

2.1 Design Requirements

2.1.1 Acoustic Characteristics

The acoustic properties of the wall panels shall comply with the requirements of the approved Noise Study, if applicable, and unless otherwise specified, the density of the wall panels shall not be less than 20 kg/m^2.

2.1.2 Aesthetic Requirements:

The following requirements shall apply:

(i) No material other than concrete shall be visible on the public street side of the wall;

(ii) Except for steel posts (where used), no material other than concrete shall be visible on the non-public street side of the wall:

(iii) A patterned finish shall be provided on both sides of the wall panels;

(iv) All exposed concrete components shall be manufactured with an impregnated colour except where accents are permitted in natural grey.

2.1.3 Structural Design Criteria

Noise barrier wall systems shall be designed as a slender structure in accordance with the requirements of Clause 5-7 of the Ontario Highway Bridge Design Code (OHBDC) and to support the applicable dead loads, wind and ice accretion loads. Climatic design data shall be in accordance with Appendix A2-1 of OHBDC with a reference wind pressure based on a 25 year return period. Wind pressures shall be calculated in accordance with Appendix A2-2 of OHBDC.

Structural Design of noise barrier walls shall comply with CSA Standards A23-1, A23.4 and S16.1 as applicable. The design of foundations shall comply with Section 4.2 of the Ontario Building Code.

Particular care shall be given to the design and detailing of the end bearing supports for the lowest wall panels. Where steel posts are utilized, a galvanized steel bracket shall be provided. Where precast concrete posts are utilized, a galvanized steel

bracket shall be provided or the footing concrete shall be extended (formed and reinforced to provide a satisfactory bearing surface) to the appropriate elevation.

The recommendations of the Geotechnical Report shall be adhered to in the design of foundations. In particular, the extent of compaction and future consolidation of earth embankments or berms shall be considered. Where footings are to be installed in an embankment condition, the embedment depth shall be increased to reflect the reduction in lateral restraint as determined by the Geotechnical Engineer, as well as the bearing capacity of the fill.

2.2 Material Specifications

2.2.1 Concrete for Precast Panels and Posts

Materials and production of concrete shall comply with CSA Standards A23.1 and A23.4, Specific requirements for this specification shall be as follows:

Class of concrete:	35 MPa at 28 days (minimum)
Course Aggregate: (crushed stone)	20 mm nominal maximum size
Water Cement Ratio:	0.4 (maximum)
Air Content:	5 to 8%
Resistance to Salt Scaling:	Loss of Mass not to exceed 0.8 Kg/m2 from the surface after 50 cycels of freezing and thawing when tested in accordance with OPSS 1352.
Water Absorption:	5% (when tested in accordance with CSA A23.2
Concrete to Reinforcing Steel Bond Stress:	Mpa (Ultimate)

2.2.2 Concrete for Foundation

Materials and production of concrete shall comply with CSA A23.1. Specific requirements for this Specification shall be as follows:

Class of Concrete	30 Mpa at 28 days (minimum)
Water Cement Ratio:	0.5 (maximum)
Air Content:	5 to 8%

2.2.3 Reinforcing Steel

Reinforcing steel shall conform to the requirements of CSA Standard G30.12 for grades 350 and 400 and to CSA Standard G30.16 for grade 400W. Reinforcing steel shall be epoxy coated for precast concrete panels, conforming to OPSS 1442. Epoxy coated reinforcing steel shall be supplied from an approved

source listed in the current version of the Ontario Ministry of Transportation Designated Sources Manual DSM #9.65.70.

2.2.4 Structural Steel

Structural Steel materials, design and fabrication shall conform to CAN/CSA Standard G40.21-92 Grade 300W and CAN/CSA-S16.1 All members shall be hot dipped galvanized conforming to CAN/CSA-G164.

2.3 Manufacture and Testing of Precast Concrete Components

2.3.1 Manufacture of Precast Concrete Components

Manufacture of precast concrete components shall conform to CSA A23.4. Concrete cover to reinforcing steel shall be 50 mm (tolerance of ± 5 mm) in other locations. The concrete cover may be reduced to 30mm (tolerance of ± 5 mm) on the non-road side provided the slides of the pre-cast concrete components are appropriately marked so that the correct placement orientation can be easily verified on site. The method of demarcation shall be agreed to with the Municipality before manufacturing is commenced.

2.3.2 Inspection and Testing of Precast Concrete Components

Precast concrete components manufactured for use on a Municipal project shall be inspected and tested by an Independent Testing Company engaged by the Municipality. Precast concrete components manufactured for use on a non-Municipal project (e.g. Subdivision) shall be inspected and tested by an Independent Testing Company engaged by the Project Proponent. The selection of sample components for testing shall be made by the Independent Testing Company in conjunction with a representative of the Municipality. Random samples shall be taken from manufactured components in the plant and/or from components delivered on site. The precast concrete Supplier will be responsible for notifying the Municipality when the components are ready for inspection and the Supplier shall provide free and ready access to facilitate the inspection and testing to be carried out.

The tests to be carried out shall include but shall not be limited to:

- Comprehensive strength
- Absorption and Density:
- Air Void Content:
- Concrete Cover:
- Dimensions, straightness and finish:
- Bond Stress (concrete to reinforcing).

The report of the Testing Company shall be signed and sealed by a professional Engineer licensed by the Professional Engineers of Ontario.

If any precast components fail to meet the requirements of this Specification, all units represented by the failed test(s) shall be deemed rejected unless results of additional testing prove to be satisfactory as determined by the Municipality. Acceptance by the Municipality of satisfactory test results does not relieve the Supplier of his responsibility for performance of the product under the Guarantee.

3 PART 3: EXECUTION

3.1 Site Preparation and Grading

3.1.1 Prior to installation of the wall, the surrounding area shall be graded to within 50mm of the specified final grade. Where the subgrade has been filled, certification of acceptability by a Geotechnical Engineer shall be submitted to the Municipality for approval before wall installation is commenced.

3.1.2 Final grading shall be completed to provide a minimum of cover of 50mm to the base of the wall panels. The earth and/or pavement shall be sloped away from the wall at a minimum slope of 2% and a maximum of 25% for a distance of 500mm. All earth fill shall be compacted to a minimum of 95% Standard Proctor Density.

3.1.3 Where stepping is required to accommodate changes in vertical alignment, the stepping shall occur at the posts and the difference in elevation shall be graded at a maximum of 3;1 with the higher elevation extending a minimum of 150 mm beyond the post to ensure that there are no gaps under the wall.

3.2 Foundations

3.2.1 Concrete for drilled footings shall be cast against undisturbed soil except for the top 600 mm which shall be formed by sonotube.

If the other than drilled footings are used, the footings shall be formed for a minimum height of 1200mm, and the excavation shall be subsequently backfilled with granular materials compacted to 98% Standard Protocol Density.

Where required, mass concrete (15 MPa) shall be used to raise the base of the footing to the required level. The tops of all footings shall be sloped away from the post to avoid ponding of water except for the bearing area of the wall panels which shall be constructed as designed and shown on the approved drawing(s).

3.2.2 The founding elevations of the foundations shall be verified by the Geotechnical Engineer based on an inspection of the site conditions before concrete is placed and shall in all cases provide frost protection to the approved finished grade in conformity with the Ontario Building Code. A written Report shall be provided by the Geotechnical Engineer confirming the acceptability of the foundation bearing conditions.

3.2.3 Concrete used in the foundation shall be tested by an Independent Testing Company engaged by the Consulting Engineer or Municipality for

compliance with the Specification. A copy of the Test Report(s) shall be provided to the Municipality.

If the test results fail to meet the requirements of the Specification, the work represented by the failed test(s) shall be deemed rejected unless the results of additional testing prove to be satisfactory as determined by the Municipality.

3.2.4 The concrete in the footings shall be allowed to cure for a minimum of 7 days before the wall panels are installed. Acceptability of a 7 day concrete test shall be obtained before wall panel erection commences.

3.3 Erection of Walls

3.3.1 The walls shall be constructed to the height and alignment as approved by the Municipality. The constructed height shall be within 50mm of the specified height5, and posts and wall panels shall be level and plumb within tolerance of 6mm in 1m.

3.3.2 Where stepping is required to accommodate grade changes, the steps between panels shall be at even increments and shall be not less than 50mm nor greater than 150 mm, except as authorized by the Municipality.

3.3.3 The lowest wall panel or beam shall bear on level bearing surface designed for applicable shear forces, and as shown on the shop drawings. The use of galvanized steel shims for levelling shall only be used with the approval of the Engineer. If shims are used, a non-shrink grout (Masterflow 713 by Master Builders or approved equal) may be required to provide an acceptable bearing condition as determined by the Municipality.

3.3.4 All components shall have a snug fit with a permitted lateral tolerance of 3mm and a 10 mm longitude tolerance between panels and posts.

3.3.5 Components which are damaged upon delivery on site, during installation, or are otherwise visibly defective shall not be used and shall be disposed of offsite.

3.3.6 All field welds shall conform to CSA Standards W47.1 and W59.

3.3.7 Galvanized surfaces which are damaged shall be cleaned and painted with an organic zinc-rich paint conforming to the requirements of CGSB Standard 1-GP181-M and to match the colour of the surrounding surfaces.

3.4 Clean Up

3.4.1 Soil, concrete, or other materials shall be removed from the exposed wall surfaces to the satisfaction of the Municipality.

3.4.2 The site shall be cleared of all debris resulting from the wall insulation.

3.5 Certification of the Wall Installation and Performance Acceptance

3.5.1 Prior to performance Acceptance, the Consulting Engineer shall submit the following documentation to the Municipality.

- One (1) set of As-Built prints marked up to show changes made during construction;
- A digital file in Microstation format and Mylar copies of the As-Constructed drawings (as stipulated by the Municipality);
- Copies of Field Test Reports including foundation, compaction, and concrete testing;
- Certification letter, certifying that the wall has been constructed in accordance with approved drawings

3.5.2 Upon Receipt of the documentation referred to in 3.5.1, the Municipality will inspect the work and, if acceptable grant Performance Acceptance subject to the reflection of any deficiencies identified by the Municipality.

3.6 Guarantee a Maintenance Period

3.6.1 The wall shall be guaranteed for a period of three (3) years from the date of Performance Acceptance. At the termination of the Maintenance Period an inspection will be carried out by the Consulting Engineer and the Municipality. Any wall components which exhibit defects that are likely to affect the longevity of the wall (such as cracking, spalling or other visible defects) shall be replaced. The tolerance for plumbness and levelness shall be 8mm per metre.

3.6.2 Defects identified by the Consulting Engineer and /or Municipality shall be rectified to the satisfaction of the Municipality prior to Final Acceptance being issued