2. NOISE BARRIER DESIGN STANDARD

COMMITTEE RECOMMENDATIONS AS AMENDED

That Council:

1. Adopt the "Proposed Noise Barrier Design Standard" attached at Annex "A";

2. Adopt the provisional list of products and suppliers/manufacturers listed in Annex "B" to be acceptable for installation in RMOC;

3. Allow staff to amend Annex "B" as they see fit subject to the presentation of appropriate evidence from new manufacturers/suppliers in accordance with the proposed noise barrier design standard at Annex "A";

4. Approve that reference to Ontario Building Code (OBC) standards be removed from the RMOC's Design Standard for Noise Barriers;

5. Approve that soft landscaping that could include trees and vines, be mandatory for all noise barriers.

DOCUMENTATION

1. Planning and Development Approvals Commissioner report dated 21 December 1999 is immediately attached.

2. Harmer Podolak Engineering Consultants Inc. letter dated 31 January 2000 immediately follows the report.

3. Extract of Draft Minute, Transportation Committee, 2 February 2000, will be distributed prior to Council and will include a record of the vote.

REGION OF OTTAWA-CARLETON REPORT
RÉGION D'OTTAWA-CARLETON RAPPORT

Our File/N/Réf. 42-98-0008
Your File/V/Réf.

DATE 21 December 1999

TO/DEST. Coordinator Transportation Committee

FROM/EXP. Planning and Development Approvals Department Commissioner

SUBJECT/OBJET **NOISE BARRIER DESIGN STANDARD**

DEPARTMENTAL RECOMMENDATIONS

That the Transportation Committee recommend Council:

1. **Adopt the "Proposed Noise Barrier Design Standard" attached at Annex "A";**

2. **Adopt the provisional list of products and suppliers/manufacturers listed in Annex "B" to be acceptable for installation in ROC;**

3. **Allow staff to amend Annex "B" as they see fit subject to the presentation of appropriate evidence from new manufacturers/suppliers in accordance with the proposed noise barrier design standard at Annex "A".**

BACKGROUND

At its meeting on the 17th June 1998 Transportation Committee adopted the following motion *"That the RMOC revisit the available products for compliance with the RMOC Standard for Noise Barriers - November 1994".*

Staff had realized that from time to time the noise barrier industry had expressed some concern with the Region's noise barrier standard, which was largely based on the (recently adopted) CSA Draft Standard for Noise Barriers on Roadways, the most current version being dated 21 November 1996 (The approved CSA standard is still in-print at the time of writing this Report).

CONSULTING ASSISTANCE

In September 1998 the acoustical consulting firm, S.S. Wilson Associates, Richmond Hill, Ontario was given the assignment, under delegated authority, to assist in the completion of a report addressing the Committee directive.

Reflecting the concerns of the industry with the existing ROC standard, the assignment was expanded to achieve the following primary objectives.

- To investigate and report on commercially available sound barrier wall products for compliance with the current ROC Standard for Noise Barriers.

- To recommend appropriate revisions to the ROC Barrier Standard document based on technical, administrative, and economic considerations.

- To prepare the text of the proposed revised ROC Barrier Standard in consultation with ROC staff.

- To prepare a list of sound barrier manufacturers/suppliers who could meet the proposed revised ROC Barrier Standard.

Staff from the Planning/Development Approvals and the Transportation/Environmental Services Departments collaborated with the consultant, Mr. Hazem Gidamy P. Eng. in the development of the report and the preparation of the revised text of the ROC Standard.

Mr. Gidamy has provided acoustical expertise to the Region on many occasions in the past.

STUDY FINDINGS

a) Compliance of available products with the current ROC Standard for Noise Barriers

- There are no CSA certified sound barriers on the market since the CSA 1996 draft standard for sound barriers has just been approved as a final standard in November 1999.

- Explicitly speaking, only one company in Toronto (International Fence) provides a 20-year warranty on the material, which is precast concrete panels. Implicitly speaking the Durisol Company in Hamilton may provide up to a 15-year warranty, (Durisol has been used on most of the MTO Highway projects where the MTO specifies 20 years maintenance free barriers). Alcuf International's warranty of 20-years is for the frame only.

- All companies provide up to a 3-year warranty on the entire installation and specifically the labour part necessary to repair barrier settlement problems.

- Steel sound barriers can provide up to a 20-year warranty. Our recent experience with the removal of the Queensway (Highway 417)/DuMaurier Avenue barrier provided a good indication that the 17-year old steel barrier installation was in relatively excellent shape and could have easily surpassed the 20-year mark.

- Experience with many barriers shows that the first problems that may develop with sound barriers are those related to ground settlement, damage due to accidents, graffiti and warping (wooden barriers only).

- It is a well known fact that some wood species, such as western red cedar (and to a lesser extent northern white cedar) can last well over 20 years as durable outdoor materials. However, the problem with wooden sound barriers is primarily due to faulty installation and warping.

- The CSA standard specifies wood barriers to be laminated, which does not exist commercially for outdoor use.

- Other wood products, such as pressure-treated wood, can theoretically provide the 20-year maintenance free period, however, installation problems can make such products a problem beyond one or two years.

In summary, while the use of 20-year maintenance free barrier material is desirable, such a requirement is stringent at this time given the fact that other installation problems and real life exposure to the outdoor elements pose difficulties for barriers. However, the use of carefully designed wood barrier systems should be encouraged as wood barriers are cost effective and can be maintained with the least cost to homeowners.

b) Recommended Revisions to ROC Noise Barrier Standard

In view of the findings in (a) above a critical review of the ROC's current noise barrier standard was carried out. The following comments on the existing standard are considered important:

- The document was published as an "isolated" document without cross-referencing other applicable ROC noise control guideline documents.

- The format of the text and the intent of the document is more suited for CSA certification and not for municipal implementation.

- While the specified minimum surface density of 20kg/sq.m is consistent with the MOE and the ROC noise guidelines, the use of a minimum Sound Transmission Class (STC) of 32 for untested materials is rather restrictive.

- The specified 0.5m barrier height increments is rather large for municipal applications.

- Restriction of panel ribbing to the vertical direction limits the choices of many good barrier designs that do not have water ponding or entrapment problems.

- The choice by CSA of 20 years maintenance free lifespan for barrier materials is rather arbitrary and not warranted. There are many popular home products and materials that do not have such a

requirement, and homeowners have accepted their maintenance after several years of service. This includes other non-acoustical fences, driveways, wooden window frames, roofing materials, etc.

- The CSA standard and the ROC barrier standard are limited to roadway noise, while the ROC mandate also include railway noise and stationary sources of noise.

- For wooden barriers, pressure treating of wood does not guarantee against decay for a minimum of 20 years if the wood is cut and used with exposed and untreated edges.

- There are no commercially available "laminated" wood boards for outdoor use. True lamination is only suitable for indoor applications. Moreover, lamination is not the only method to avoid warping and loosening of panels.

- It is not possible to construct a barrier and provide a 20 year full warranty on the labour and material without a significant cost increase to the developer and the homeowner.

- The maximum barrier height limit of 2m contradicts other ROC approved noise guidelines.

- Aesthetics and visual relief should be consistent with the Municipal policies and the ROC barrier policy.

In view of the above critical findings, a revised ROC Standard for Noise Barriers is proposed. This document is to be found at Annex "A".

c) List of current suppliers/manufacturers

Finally, attached at Annex "B" is a list of Noise Barrier Suppliers/Manufacturers whose products can meet the requirement of the proposed standard document at Annex "A".

CONCLUSION

For many years there was concern expressed by suppliers/manufacturers that the ROC Noise Barrier Standard, based as it was on a draft CSA standard, was virtually impossible to comply with.

The proposed ROC standard being recommended will result in the following being achieved:

- meet the acoustic criteria;
- allow use of competitive products (4 of the barrier manufacturers are ROC based);
- limit the possibility of a monopoly;
- not restrict the industry from developing acceptable design alternatives;
- encourage the use of consumer-friendly products that homeowners can relate to and maintain;
- provide realistic warranties that focus on the barrier system and not only on panels or materials;
- relate the standard to other current ROC Noise Control Guidelines;
- and provide effective implementation procedures for barrier design and installation.

Regional Official Plan/Transportation Master Plan

The ROP contains policies to ensure that communities are not subject to unacceptable levels of noise. An appropriate noise barrier design standard helps achieve this objective.

Approved by
Nick Tunnacliffe, MCIP, RPP

ANNEX A

PROPOSED NOISE BARRIER

DESIGN

STANDARD

6.0 PROPOSED REVISION TO THE ROC STANDARD FOR NOISE BARRIERS

6.1 BASIC PRINCIPLES

The following summarize the basic principles adopted to revise the current ROC Standard For Noise Barriers document:

1. To focus on meeting the acoustic criteria.
2. Allow the use of competitive products and limit the possible monopoly that may develop.
3. Not restrict the industry from developing various acceptable design alternatives.
4. Encourage the use of friendly products that homeowners can relate to or maintain, where necessary.
5. Provide realistic warranties that focus on the barrier ***system*** and not only on the panels or material.
6. Relate the barrier standards to the current ROC Noise Control Guidelines.
7. Provide effective implementation procedures for barrier design and installation.

6.2 THE PROPOSED ROC NOISE BARRIER STANDARD

Preface

This Standard specifies requirements for design, material and construction of noise barriers.

This standard complement the following ROC Noise Control guidelines:

- Noise Control Guidelines For New Developments Adjacent to Existing and Proposed Regional Roads and Transitways.
- Noise Control Guidelines For New Construction, Reconstruction and Widening of Regional Roads and Transitways.

The use of this Standard is expected to result in a higher quality noise barrier system and lower capital and maintenance costs to both, the residents in the case of developer – constructed barriers, and to the Region in the case of retrofit or capital works projects.

This standard is subject to periodic review, and suggestions for their improvement may be referred to the appropriate ROC Office.

All inquiries regarding this Standard, including requests for interpretation, should be addressed to:

Region of Ottawa Carleton
Environment and Transportation Department
111 Lisgar Street, 4th Floor
Ottawa Ontario,
K2P 2L7

Requests for interpretation should:

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;
(b) provide an explanation of circumstances surrounding the actual field condition.

1. Scope and Application

1.1 Scope

This standard provides outline specifications for the design and installation of roadway and railway noise barriers constructed or approved by the Region of Ottawa-Carleton. The specific requirements described in this standard are not to be considered all inclusive. Any new design, material or installation technique not specifically addressed in this standard should be evaluated with the general fundamentals of acoustics, durability, safety, and functionality in mind.

This standard applies to noise barriers constructed by the ROC in connection with Regional Road capital works projects that may be subject to the EA process and in retrofit noise barriers undertaken by the ROC. The standard also applies to noise barriers approved by the ROC in connection with new development projects subject to the ROC approval process.

1.2 Application of the CSA Standard For Noise Barriers on Roadways to Projects in the ROC

Certification organizations, such as the Canadian Standards Association, as accredited by the Standards Council of Canada, have their own criteria and procedures for certification services. CSA provides certification services for manufacturers who, under license from CSA , wish to use the appropriate registered CSA Marks on certain products of their manufacture to indicate conformity with CSA Standards.

It should be noted that the CSA Standard for Noise Barriers is neither binding on the manufacturers of noise barriers nor on the approval agencies. The CSA Standard was developed to promote standardization of the noise barrier industry across the country with a view to developing a safe, durable and effective product.

It is the intent of the Region, however, to accept noise barriers bearing the CSA Mark as meeting the ROC Noise Barrier Standard in addition to other noise barrier systems that meet this ROC Standard.

The objectives of the ROC Standard will, therefore be as follows:

1. To endorse noise barrier systems bearing the CSA Mark for use in the Region.
2. To allow the use of alternate noise barrier systems that may not bear the CSA Marks, but meet the technical requirements of this ROC Standard.
3. To give serious consideration to noise barrier systems manufactured by local manufacturers in the Region of Ottawa-Carleton which either meet the ROC Standard or have proven themselves to be worthy of consideration based on successful installations that "stood the test of time".
4. To encourage more local manufacturers to develop a variety of quality and safe products that meet the ROC Standard, and ultimately the CSA Standard.
5. To provide the necessary flexibility in meeting site specific challenges or problems with the use of qualified and professional expertise in the areas of structural and geotechnical engineering and landscape architecture fields.
6. To provide integrated solutions to environmental noise issues and their controls in accordance with other ROC noise policies and guidelines.

2. Design

The details presented in this Standard refer to noise barriers as a total and integrated system of various components including the base berm, if any, the wall and all other associated components as defined herein.

All individual components to be designed to be capable of being assembled on site to conform to the finished structure as indicated by the drawings and specifications. The panels to be designed to facilitate ease of on-site replacement.

2.1 Acoustics

2.1.1 Material Density/Sound Transmission Class (STC) Requirements

For a panel to be qualified as a sound barrier material, one or more of the following conditions should be met:

- The surface density of the panel material to be not less than 20 kg/sq.m.
- The Sound Transmission Class (STC) of the panel material to be 20 or greater when tested in accordance with ASTM-E90 (a test report to be submitted for approval).
- The Sound Transmission Class (STC) of the panel material has historically been demonstrated to be 30 or greater.

In addition, sufficient measures are to be taken to prevent drumming of the panels caused by wind or ground vibration.

2.1.2 Noise Reduction Coefficient (NRC)

If the noise barrier system is specified by the Acoustical Consultant to be sound absorptive, the panels should be tested to determine the Noise Reduction Coefficient (NRC) in accordance with ASTM-C423. A panel or an assembly of panels should be tested as required in accordance with the ASTM Procedures for free-standing screens.

2.2 Expansion Joints

When a noise barrier alignment traverses structure expansion joints, the noise barrier is to be designed and installed so as to accommodate movement of the noise barrier panel without placing undue stress on the structure and the noise barrier installation, or reducing acoustical attenuation. The joints in the noise barrier are to match the size and location of the structure joints.

2.3 Height

The noise barrier system design should provide details of methods and materials to be used to accommodate varying wall heights above the top of footing.

2.4 Panel Orientation

Noise barrier elements should be designed and oriented to minimize entrapment and ponding of water, and accumulation and infiltration of dirt and debris inside and on any surface of any component. Corrugated or ribbed panels should be mounted such that the features are oriented vertically.

2.5 Panels with Fire Hose Access

Noise barrier panels with fire hose access openings, if required, shall be designed with additional reinforcement and protective coating around the opening as necessary to maintain structural integrity.

3. Materials

3.1 General

For materials not specifically included in this section, the manufacturer should demonstrate to the Region that the material has a minimum predicted maintenance free lifespan of 15 years.

All materials should have a flame spread classification less than or equal to 140 and smoke developed classification less than or equal to 180 when tested in accordance with the ULC standards.

Metal and non-metallic components of noise barrier systems including their performance, such as corrosion and weathering, to be in accordance with the applicable CSA, ASTM, CAN/ULC, ULC, CSA/CAN and ANSI standards, where available.

3.2 Coatings

Coatings refer to all paints, stains and laminates. All coated components to be rated for accelerated weathering. All coated steel components to be resistant to corrosion.

Components which are hot dip galvanized or coated with a polyvinyl chloride (PVC) plastisol using an epoxy primer using no adhesives for bonding, need not have accelerated weathering test data

3.3 Concrete Panels and Posts

3.3.1 Cast-in-Place

Cast-in-place concrete to conform to the requirements of the CSA Standards.

3.3.2 Precast

Precast concrete to conform to the requirements of the CSA Standards.

3.3.3 Steel Reinforcing

All steel reinforcing to conform to the requirements of the CSA Standards. The bars to be free from rust, scale or other substances that will prevent bonding.

All reinforcing bars should be epoxy coated conforming to ASTM Standards.

The concrete cover over the steel reinforcing should meet the requirements of the CSA Standards.

3.4 Metal Components

All metal components to be either fabricated of nonferrous materials or hot dip galvanized after fabrication according to the requirements of CSA Standards. All welding to conform to CSA Standards.

3.5 Steel Panels

Panels exposed to traffic and snow removal operations to be minimum nominal 0.91 mm galvanized steel (20 gauge). All other panels to be of minimum nominal 0.76 mm galvanized steel (22 gauge). All steel sheeting components to be coated with a material meeting the requirements of this standard.

Acceptable products include galvanized panels and then coated with an organic polyvinyl chloride (PVC) plastisol using an epoxy primer using no adhesives for bonding. The coating system thickness must be 200 μm on the surfaces exposed to traffic and snow removal operations and 100 μm thick on all other panel surfaces.

Pop-rivets shall be either aluminum with an aluminum mandrel or aluminum with a stainless steel mandrel.

3.6 Sound Absorptive Filler Material

Sound absorptive materials used to fill cavities in double walled noise barrier systems to increase sound absorption shall be semi-rigid type.

The noise reduction coefficient (NRC) shall be not less than 0.70.

3.7 Wood Components

All wood products to be either naturally resistant to decay for a minimum of 20 years or to be pressure treated. The panel must be composed of tightly fitted wood boards so as to avoid warping, splitting and loosening of particles, knots and imperfections. All boards must be tightly butted and secured.

The use of board-on-board panels to meet the stated density/acoustic criteria is acceptable provided that the boards are thoroughly-secured. In addition, board-on-board panels shall have tightly butted joints that are staggered with provision to allow for expansion/contraction and for making the necessary field adjustments (e.g. for tightening up of developed gaps), where required .

The use of Tongue and Groove, and V-joints for joining panels is acceptable provided that the tongue or V-joint extent is not less than 19mm (3/4") long.

Nails and other fastening devices must be either hot dip galvanized steel, or made of nonferrous or stainless steel.

When there is ground contact with wood, the wood must be pressure treated and cut ends to be also treated or protected from moisture penetration.

For wooden noise barriers, the following are the minimum acceptable features to qualify as an acceptable noise barrier system:

a. All wood shall be selected for good appearance and free of defects and large/heavy knots. In addition, all torn grain and surface stains shall be eliminated by appropriate surface refinishing.
b. All skirts coming in contact with the ground/soil shall be pressure treated with finished cut edges and to be buried 100 to 150mm below the finished ground level.
c. All exposed panels to be dressed with beveled edges on both sides.
d. All wooden posts (metal posts are also acceptable) to have minimum dimensions of 140 x 140mm or larger as required by the governing code, dressed to pattern.
e. Double posts are required on all directional changes greater than 20^{o}.
f. Install coping on top of panels using one piece wood (or other acceptable metal products)
g. The use of decorative elements such as pilasters, curved (scalloped) top rail, post caps, wood designs, etc. is preferable. In all cases, the decorative elements should not affect the minimum barrier height requirements, the density or any other acoustic/structural requirements.
h. Wood and/or metal frames to be used to support the wood panels in place and to be designed to allow expansion/contraction of the wood panels/elements and for making the necessary field adjustments, where required.
i. All metal components, if any, used in a wooden sound barrier to conform to the metal or steel component specifications in this Standard.

3.8 Brick

All bricks used to be in accordance with the CSA standards.

4. Installation

All work and noise barrier materials for specific installations are subject to field certification by the design professionals to ensure adherence to the requirements in this specification.

The noise barrier should be installed to meet the reference wind pressure as described by the Authority for the specific location of each installation.

All materials delivered to the construction site should be visually inspected by the owner and/or their representatives for proper dimensions, cracks, voids, surface defects, inconsistency in colour and texture, and any other damage or imperfections.

4.1 Height and Alignment

The noise barrier to be constructed to the height and alignment as specified by the Acoustical Consultant. The minimum specified height of the noise barrier to be maintained at all times.

4.2 Footings and Posts

The site-specific type, depth, size and shape of the foundations to be determined in accordance with the OBC for barrier wall heights not exceeding 3m and with OHBDC for barrier walls exceeding 3m high based on the determined soil design parameters along the alignment of the noise barrier.

4.3 Site Grading and Preparation

Grading and berm construction in association with noise barrier installation to be completed to a minimum of 25 mm below the bottom of the barrier prior to constructing the barrier foundation.

Earth grading and/or paving at the base of the noise barrier panels and posts to be such that the bottom panels are effectively buried to a minimum depth of 100 mm to avoid any gaps. The earth and/or pavement to be sloped away from the installation at a minimum slope of 2% and a maximum of 50% to prevent the washout of soil at the base of the noise barrier.

All graded earth to be compacted to at least 95% Proctor.

Changes in alignment to occur at the posts by suitable means to avoid acoustical degradation.

5. Masonry Walls

Masonry walls to be installed in accordance with the requirements of AASHTO Guide Specifications for Structural Design of Sound Barriers.

Bricks to be installed on a suitable foundation not less than 500 mm above the final groundline.

The top row of all masonry walls and posts to be protected with coping and/or flashing.

Mortar used to set the bricks, shall be in accordance with the CSA Standards.

6. Fire Hydrant Access

When the installation of a noise barrier interferes with the access to existing or proposed fire hydrants, the noise barrier installation should include fire hose access openings and associated identification signs. Location and demand for these openings to be established in cooperation with the local fire departments.

7. Overhead High Voltage Lines

Where the potential of arcing exists due to the close proximity of existing overhead high voltage lines. each metal panel and girt must be grounded in accordance with CSA Standards.

8. Other Considerations

8.1 Aesthetics

The design of noise barriers along Regional Roads and Transitways should also have regards to the following:

1. The applicable Regional and Local Municipal urban design guidelines and landscaping requirements.
2. The ROC's recommended drainage and grading consideration as well as the landscaping design and aesthetic principles for noise barriers included in the Background Reports to the ROC Noise Control Guideline documents.

8.2 Resonance (Drumming Effect)

To avoid excessive resonance by certain noise barrier wall materials, such as metal panels, the barrier system to be designed to reduce this phenomena by acceptable means such as with the use of additional stiffners, the application of noise damping compounds, sandwich construction, etc.

9. Footing and Structural Design

Footings design, depth, soil condition, compaction, etc. to be certified by a Professional Engineer.

10. Approval By The Region

10.1 Noise Barrier System

In order for the noise barrier system design and material to be considered for approval, the submission should provide the following:

(a) The trade name of the product, if applicable.
(b) The manufacturer's name and address.
(c) Footing design calculations or certification by a Geotechnical Consultant.
(d) Structural design calculations for posts and panels or certification by a Structural Engineer.
(e) Detailed drawings of the entire noise barrier system and all its components.
(f) A general statement as to the composition of the material.
(g) Specifications regarding installation requirements as well as sequence of construction.

(h) Noise Reduction Coefficient (NRC) report if the noise barrier is to be considered as sound absorptive; if required by the noise study.
(i) Sound Transmission Class (STC) and/or the material surface density.
(j) Detailed material specifications.

Any new design, material or installation technique for a noise barrier system will be evaluated for acceptability of use in the Region with a view to safety, durability, functionality and cost effectiveness.

The Design drawings and calculations shall be signed, sealed and dated by Professional Engineer(s) licensed in the area of expertise for which the approval is being sought.

10.2 List of Approved Suppliers

The ROC will establish a list of approved suppliers of noise barrier systems which will be periodically reviewed and updated by the Regional staff.

11. Execution

This section deals with the execution of the required work in connection with site-specific noise barriers including design, submission, approval, construction and completion of the contracted work.

The following subsections briefly describe the minimum required data and specifications to obtain approval from the Region:

11.1 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 the details of noise barrier system components including material specifications.

(ii) Structural drawing(s), signed and sealed by a Professional Engineer licensed by the Professional Engineers of Ontario (with documented experience in Structural Engineering design), showing foundation details 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.

(iv) A covering letter stating deviations or exceptions to the Regional Standard and the reasons/justification for the deviations.

11.2 Site Preparation and Grading

11.3 Foundations

11.4 Delivery, Handling, Storage and Protection

11.5 Erection / Installation of Noise Barrier

11.6 Clean Up

11.7 Testing, Inspection and Quality Assurance

11.8 Final Certification and Performance Acceptance

11.9 Guarantee and Maintenance Period

- The noise barrier system (material and installation) to be guaranteed for a minimum period of three (3) years from the date of the initial Certification and Performance Acceptance.
- After 3 years from Certification, an inspection is to be carried out by the Engineer with a report to be submitted to the Region. Any components which exhibit defects that are likely to affect the longevity of the barrier shall be replaced and/or repaired. A Final Certification by the Engineer to be prepared and submitted to the Region.

12. Definitions

The following definitions apply in this Standard:

Sound Transmission Class:

Sound Transmission Class (STC) - is a single-number rating of the capacity of a structure to prevent sound from reaching a receiving location. It is calculated in accordance with ASTM Classification E413 using values of sound-transmission loss measured in accordance with ASTM Test Method E90. It provides an estimate of the performance of a partition in dealing with certain common sound insulation problems.

Noise Reduction Coefficient:

Noise Reduction Coefficient (NRC)- is a single-number rating of the sound-absorptive property of a material. It is calculated as the average of the sound-absorption coefficients, measured in accordance with ASTM Test Method C423, at 250, 500, 1000 and 2000 Hz, and rounded to the nearest multiple of 0.05.

Panel:

The panel component of a noise barrier is that portion which, when joined together, produces a solid wall. In most cases, the panels span the distance between supports.

Post:

Posts are usually considered as vertical supports for the noise barrier panels.

Noise Barrier / Noise Barrier System:

Noise Barrier as referred to in this Standard refers to the noise barrier as **system** which includes the panels, posts, foundation, methods of design and construction details, finish and all other components as approved by the Region for inclusion in the ROC's List of Approved Suppliers.

Supplier:

Supplier refers to the manufacturer of the noise barriers / noise barrier system and/or its representative responsible for making the necessary technical submissions to the Region as Well as well as the supply of the noise barrier system components.

Engineer or Consulting Engineer

Engineer or Consulting Engineer shall mean the Professional Engineer or the Engineering firm engaged by the Supplier and/or project proponent to design and certify the noise barrier system. The Engineer shall have documented experience in the design, construction and review of Structural and/or Geotechnical Engineering Projects as required.

Acoustical Consultant

Acoustical Consultant is a Professional Engineer (P. Eng.), licensed by the Professional Engineers of Ontario (PEO) to practice in the Province of Ontario, with demonstrated experience in the field of acoustics and noise control.

ANNEX B

NOISE SYSTEM BARRIER SUPPLIERS/MANUFACTURERS THAT CAN MEET THE REVISED ROC STANDARD

Company	**Primary Noise Barrier Material/System, Finish, ….**
Prestige Fence	Steel frame system with wood infill panels (white pine)
Central Precast	Precast concrete panels with reflective or absorptive finishes
Alcuf International	Aluminum frame system with a variety of infill panel materials including wood, steel composites and proprietary boards.
International Fence	Precast concrete panels (Vertarib 2000) smooth finish or broom finish.
Durisol	Composite concrete/wood chip panels and steel frames
Homeland Vinyl Fencing Ltd	Composite PVC (Vinyl), wood or steel posts
Compact Industries	Primarily wood with wood or steel posts
Nex Products Inc.	Composite using waste recycled materials

Harmer Podolak
ENGINEERING CONSULTANTS INC.
Tel (613) 828-4445 Fax (613) 828-4077

January 31, 2000

Mr. Nicholas Heinz
Prestige Fence
163 Cardevco Road
Carp, Ontario K0A 1L0

Dear Sir:

RE: STRUCTURAL REVIEW OF ROC NOISE BARRIER STANDARD

We have reviewed the Region of Ottawa Carleton Report No. 42-98-0008 dated December 21, 1999 and can offer the following comments.

In the last 20 years we have designed many noise barriers for clients such as the Ministry of Transportation, ROC, other Municipalities, Private Clients and also Manufacturers of noise barrier systems. Having been involved as designers, investigators, reviewers and members of manufacturer's teams, we have extensive experience with the common problems associated with the noise barriers.

Although we find the proposed standard very informative on the subject of material selection and acoustical expertise it is lacking the structural input. The seemingly innocent statement mentioned in article 4.2 ("The site-specific type, depth, size and shape of the foundations to be determined in accordance with the OBC (Ontario Building Code) for barrier wall height not exceeding 3 m and with OHBDC for barrier walls exceeding 3 m height based on the determined soil design parameters along the alignment of the noise barrier.") could potentially destroy all the effort dedicated to development of the noise barrier standards.

The Ontario Building Code does not have any provisions for the design of noise barriers. To specify the design in accordance with the Ontario Building Code could be interpreted that there would be no requirements for strength. We have been previously involved with exactly the same problem in the City of Nepean. A developer (who constructed a noise barrier that was going to be transferred to the City) claimed that the poorly constructed noise barrier would be satisfactory in accordance with the Ontario Building Code.

Presently, only OHBDC provides specific requirements for the design of noise barriers. To deliberately neglect the only design code that provides any protection from the above mentioned disputes would not be prudent. It should be noted that the transfer of infrastructure from developers to Municipalities or between Municipalities and Ministry of Transportation are quite common and in absence of design requirements could result in serious problems.

However, the problem goes much deeper than that. A noise barrier is a system of several structural elements that are interconnected through several joints which all have to be able to satisfy the design requirements. Once the restriction is removed the whole system is jeopardized. Neither the acoustical or material specifications can ensure a durable final product if the strength requirements are not observed.

Should the OHBDC Code be over-ruled for the noise barriers under 3 m, the well constructed noise barriers would gradually disappear from the market since they could not compete with the systems violating the design code.

In any case, it is quite unusual that a provincial design code would be over-ruled by a Municipal standard. When such a step is being taken it is usually in the other direction making the product safer and more durable.

It is not surprising that contractors, who are not able to construct noise barriers in accordance with the governing code in such a way that they could compete with the successful contractors, would like the standards to be lowered. However, it would perhaps be reasonable to advise them to lobby the Ministry of Transportation to change the design code.

There are also other problems that must be considered. How could an Engineer acting on behalf of ROC review any proposed noise barrier design if the strength and load criteria are not known?

Even at the present time the design of noise barriers has some difficulties that could perhaps be addressed in the standard. The existing geotechnical manual suggests that soils located within the first 1.5 - 1.8 m (depending on snow cover) should not be used to provide horizontal resistance. Of course, this requirement would have a large impact on the noise barrier design. It would be very useful to clearly indicate ROC position on this point that could potentially result in disagreements. We usually consider noise barriers to be of lesser danger to the public safety than other structures and do not implement the above requirement in our designs. However, there is not a clear direction on this design point in any of the available design standards.

In closing, we wish to point out that in addition to the structural concerns hereto described, there may also be other important standards that could potentially influence your production.

Yours truly,

HARMER PODOLAK ENGINEERING CONSULTANTS INC.

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