



Professional Engineers
Ontario

Professional Engineers Providing Acoustical Engineering Services in the Land-Use Planning Process

• 2024 •

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PROFESSIONAL ENGINEERS PROVIDING ACOUSTICAL ENGINEERING SERVICES IN THE LAND-USE PLANNING PROCESS

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Notice: The Professional Standards Committee periodically reviews guidelines to determine if a guideline is still viable and adequate. Practice bulletins may be issued from time to time to clarify statements made herein or to add information useful to those engineers engaged in this area of practice.

PURPOSE OF PEO GUIDELINES

Professional Engineers Ontario (PEO) produces guidelines to educate Licensed Engineering Practitioners (LEPs) and the public on best practices. For more information on PEO's guideline and development process, including PEO's standard form for proposing revisions to guidelines, please see the guideline [Development and Maintenance Processes](#).

To view a list of PEO guidelines, please visit the [Knowledge Centre](#) section of the PEO website.

INTRODUCTION

This Professional Engineers Ontario (PEO) guideline covers acoustical engineering services related to the land use planning process in Ontario, which may include: providing support for applications for land use approvals; design input; implementation of mitigation; and advisory services. LEPs providing acoustical engineering services should demonstrate training and/or experience in acoustical engineering related to land use planning.

PROFESSIONAL REQUIREMENTS

LEPs providing engineering services related to the land use planning process in Ontario must comply with the Code of Ethics and professional misconduct provisions of Regulation 941 under the *Professional Engineers Act*¹ (*Act*) as well as all relevant regulations, codes and standards in the province of Ontario and its local municipalities.

3.1 Conflict of Interest

Regulation 941/90 under the *Act* clearly describes the circumstances that create a conflict of interest. Section 72(2)(i) states that,

...failure to make prompt, voluntary and complete disclosure of an interest, direct or indirect, that might in any way be, or be construed as, prejudicial to the professional judgment of the practitioner in rendering service to the public, to an employer or to a client...

shall constitute professional misconduct. *Practitioner* in paragraph 72(2)(i) means the holder of a licence, a temporary licence, a provisional licence, a limited licence, or a certificate of authorization under the *Act*.

To know when disclosure is appropriate, a clear understanding of what causes a conflict of interest is needed. The simplest and most effective way to deal with a potential or perceived conflict of interest is to be forthright and to speak with the appropriate parties about any circumstances that could reasonably lead those parties to question the LEP's judgment. For more information on conflict of interest, refer to the [Professional Engineering Practice](#) guideline.

3.2 Professional Responsibility

Professional responsibility refers to obligations of LEPs to conduct themselves in accordance with the technical, legal and ethical standards of the profession, including the higher duty of care associated with professional status. Good professional conduct includes performing services only in areas of one's competence. For both legal and ethical reasons LEPs should not undertake assignments unless they reasonably believe: (i) that they are competent to carry out the work; or (ii) that they may become competent without undue delay, risk or expense to the client or employer or risk to the public. Alternatively, LEPs may engage a competent licence holder to carry out work that is beyond the expertise of the LEP. LEPs who perform work without the necessary competence may be held liable for negligence and may be subject to PEO disciplinary action. For more information on professional responsibility, refer to the [Professional Engineering Practice](#) guideline.

3.3 Assuming Responsibility and Supervising Others

In situations where an LEP assumes responsibility for unlicensed engineering work, the LEP is subject to the same standards of professional conduct and competence as if the LEP had personally completed the services. Individual engineers working for an incorporated engineering firm are also not shielded from liability by virtue of their employer's corporate structure. For more information, refer to the [Assuming Responsibility and Supervising Engineering Work](#) guideline.

3.4 Quality Control and Assurance

Quality control and quality assurance (QA/QC) programs (formal or informal) are important to all practising engineers. The safety, health and welfare of the public could be negatively impacted without access to such QA/QC programs, as these programs catch errors in engineering services and correct faulty conclusions. The establishment, implementation and monitoring of a QA/QC program or plan as part of a work program represents a commitment to fulfill an LEP's professional duty to the public interest and to each employer or client. Alternatively, LEPs may elect to have work peer reviewed by other LEPs (refer to PEO guideline

¹ *Professional Engineers Act*, R.S.O. 1990, c. P.28, R.R.O. 1990, Reg. 941

Professional Engineers Reviewing Work Prepared by Another Professional Engineer). Ultimately, a QA/QC program represents an objective review of engineering work by a qualified engineer. It is the most appropriate means of ensuring work/service excellence.

3.5 Sealing Requirements

Use of a PEO seal is governed by Section 53, O. Reg. 941, under the *Act*. The use of an engineer's seal is a matter of professional regulation and does not independently give rise to any additional civil liability.

The failure to abide by Section 53 of O. Reg. 941 of the *Act*, constitutes professional misconduct under paragraph 72(2)(g) of O. Reg. 941 of the *Act*. If in doubt, LEPs should affix the seal rather than withhold it (assuming the document being sealed was actually prepared or checked by the LEP) and involves “engineering content” as defined in section 53(1) of Regulation 941. LEPs should decide whether it is appropriate to seal a document based on the policies and procedures outlined in the *Use of the Professional Engineer's Seal* guideline.

If a document contains information for which the LEP is not responsible, the LEP should include appropriate disclaimers and qualifications to clearly denote the content of the document that will not be the subject of the seal.

3.6 Professional Competency and Disclosure

According to paragraph 72(2)(h), Regulation 941/90 under the *Act*, it is considered professional misconduct for LEPs to perform services outside areas of their competence. Furthermore, failure to reasonably comply with applicable statutes, policies, regulations, standards, codes, by-laws and rules in connection with work being undertaken by or under the responsibility of the LEP may be grounds for professional misconduct according to paragraph 72(2)(d) of Regulation 941/90 under the *Act*.

To demonstrate professional competency, it is recommended that LEPs disclose the following information in their proposals, terms of reference, engineering agreements and/or reports, as appropriate:

- 1) A summary of the LEP's relevant work experience and academic background;
- 2) The specific purpose and defined scope of the Noise/Vibration Impact Study[ies]; and
- 3) The specific statutes, regulations, codes and standards applied in the preparation of such document[s].

4.

SCOPE OF THIS GUIDELINE

The intention of this guideline is to assist LEPs who provide services in acoustical engineering related to the land use planning process in Ontario. Typically, this means preparing acoustical

assessments and studies as part of a land use application for a proposed development project or as a means of evaluating a proposed development project with the goal of demonstrating compliance and land use compatibility.

This guideline is not intended to establish a “one method of practice for all” approach to the practice of professional engineering, or to replace an LEP's professional judgement when providing professional engineering services. Subject to provisions in the guideline that incorporate professional conduct requirements or legal requirements, a decision by an LEP not to follow the guideline will not, in and of itself, indicate that an LEP has failed to maintain an acceptable standard of work. On the other hand, following the guideline may not ensure that an LEP has provided services conforming to an acceptable standard. Determining whether an LEP's service is acceptable will depend upon the circumstances of each case.

Part of the process of obtaining a land use approval may involve showing that users/occupants/residents of the proposed development will not experience “adverse effect” as defined in the *Provincial Policy Statement*² (PPS) and the *Environmental Protection Act*³ (EPA) from environmental noise or vibration. Where there is compliance with the applicable noise and vibration guidelines or legislative requirements, it is generally considered that there would not be any adverse noise or vibration effects and land use compatibility would result. However, adverse effects may still be possible even if there is compliance with applicable numerical guidelines. So, in addition to demonstrating numerical compliance, acoustical assessments and studies may also need to consider additional means of minimizing the risk of complaints—a key indication of adverse effect.

Noise/vibration impact studies may be required in support of the following development approval applications and municipally initiated planning processes: official plans, secondary plans, official plan amendments, comprehensive zoning by-laws, zoning by-law amendments, plans of subdivision, plans of condominium, and other development applications under the *Planning Act*⁴; as well as development approvals obtained under other legislation, which involve elements of land use planning (e.g., *Aggregate Resources Act*⁵ and the *Niagara Escarpment Planning and Development Act*⁶). Development projects for which acoustical engineering services may be required can be classified into several main types:

- 1) Proposed new or expansion of noise and/or vibration receptors (e.g., residential, school, hospital, laboratory) in proximity to significant transportation sources, one or more stationary sources or an employment area;

²*Provincial Policy Statement*, 2020, Ontario Ministry of Municipal Affairs and Housing

³*Environmental Protection Act*, R.S.O. 1990, c. E.19 (EPA)

⁴*Planning Act*, R.S.O. 1990, c. P.13

⁵*Aggregate Resources Act*, R.S.O. 1990, c. A.8

⁶*Niagara Escarpment Planning and Development Act*, R.S.O. 1990, c. N.2

- 2) Proposed new or expansion of noise and/or vibration sources such as commercial or industrial uses that are not classified as stationary sources by the Ministry of Environment, Conservation and Parks (MECP); and
- 3) Proposed new or expansion of noise and/or vibration sources that are classified as stationary sources by the MECP.

Some development projects may contain both receptors and sources.

5.

SCOPE OF ACOUSTICAL ENGINEERING SERVICES

The type of acoustical engineering services an LEP may be asked to provide as part of the land use approval process may include:

- 1) Due diligence studies in relation to potential environmental noise and/or vibration impact;
- 2) Land use compatibility studies in the context of environmental acoustics;
- 3) Feasibility studies and/or detailed noise and/or vibration impact studies;
- 4) Assist with the development of conditions for insertion in various agreements such as site plan approval, development or subdivision agreements;
- 5) Assistance with the acoustical design of building envelopes, including specification of sound isolation performance of building envelopes, and vibration isolation where appropriate;
- 6) Schematic design of sound barriers (e.g., placement/location and height);
- 7) Investigation and review of alternative noise/vibration mitigation methods;
- 8) Design and specification of proposed mitigation;
- 9) Field review of sound and vibration control measures;
- 10) Field measurements of sound and vibration to confirm that the mitigation is functioning as intended and compliance with the applicable criteria achieved;
- 11) Peer reviews of environmental noise and/or vibration studies/reports/submissions by others;
- 12) Attend public meetings, Council meetings and other regulatory meetings and make presentations on behalf of the client;
- 13) Expert witness testimony at court and administrative tribunal proceedings; and
- 14) Assist with the negotiation and drafting of acoustically related sections of settlement agreements.

Professional activities in other areas of acoustics are not addressed by this guideline, e.g., acoustic services in the form of the regulatory studies and assessments required: under O. Reg. 1/17 of the (EPA) *Environmental Protection Act* in association with an environmental compliance approval or environmental activity and sector registry; under O. Reg. 359/09 of the EPA for a renewable energy approval; and under the *Aggregate Resources Act*⁷.

6.

COMPETENCY

According to paragraph 72(2)(h), Regulation 941/90 under the *Act*, it is considered professional misconduct for LEPs to undertake work that they are not competent to perform by virtue of their training and experience. Furthermore, failure to make responsible provision for complying with applicable statutes, regulations, standards, codes, by-laws and rules in connection with work being undertaken by or under the responsibility of the LEP is professional misconduct according to paragraph 72(2)(d), Regulation 941/90 under the *Act*.

To provide the services within the scope of this guideline, the LEP should have knowledge of:

- 1) The relevant legislation, regulations, municipal, provincial and federal guidelines and documents that apply, including but not limited to those listed in Section 12;
- 2) The relevant standards (e.g., from organizations such as CSA, ISO, ASTM, ANSI, SAE), including but not limited to those in Section 12;
- 3) The land use planning and approval processes in Ontario under the *Planning Act*;
- 4) Acoustics of sound both indoors and outdoors, including the theoretical and practical aspects of sound measurement, prediction of sound propagation and mitigation of sound;
- 5) Architectural acoustics, specifically the sound isolation performance of construction assemblies (and calculation of same) and the prediction of indoor sound levels from outdoor sound levels (and vice versa); and
- 6) Measurement and prediction of vibration levels due to various sources (e.g., railway operations, mechanical equipment, building services, stamping presses, blasting) and appropriate mitigation.

⁷Op. Cit.

RESPONSIBILITIES OF THE LEP

It is good practice for the LEP, in consultation with the client, to prepare a detailed scope of work for incorporation in a contract for services. The detailed scope of work should be informed by the LEP's understanding of:

- 1) The proposed development and the context of the development, so the LEP understands what background information must be gathered to prepare the appropriate noise and/or vibration studies;
- 2) A land use approval authority's terms of reference for acoustic or vibration reports and/or policies that state what the acoustic or vibration report must demonstrate. Such guidance may be found in policy documents such as official plans, but may also be found in guidelines, development approval guides, etc.;
- 3) Policies, guidelines or regulations of the land use approval authority related to acoustics or other related items that may affect noise mitigation design (for example, sound barrier height limits or earth berm slope limits.) Such guidance may be found in policy documents such as official plans, in stand-alone guidelines, and in regulatory instruments such as zoning by-laws or by-laws under the municipal code, if the municipality has one. They may also be regulated through the Ontario Building Code (O. Reg. 332/12, as updated or amended from time to time).;
- 4) Any municipal noise by-law(s); and
- 5) Relevant national or international technical standards.

The LEP should:

- 1) Collaborate with other professionals involved (e.g., land use planner, air quality consultant, traffic engineer, mechanical engineer, civil engineer, landscape architect, architect);
- 2) If considered appropriate by the LEP, due to circumstances of the proposed development, consult at an early stage with the land use authority on submission requirements or other aspects specific to acoustics; and
- 3) Confirm any assumptions about the development or other matters with the client or other professionals, if appropriate.

For a new stationary source or one to be modified, such as by the addition of or change to a significant sound source, the LEP should inform the client on the need for an Environmental Compliance Approval (ECA) or Environmental Activity and Sector Registry (EASR), or amended ECA or updated EASR, as applicable and required by the Ontario Ministry of the Environment, Conservation and Parks (MECP).

In the event that the land use approval authority specifically requests one or more acoustical studies that, in the opinion of the LEP, does/do not encompass all of the acoustical sources that should

be included, the LEP should so advise the client accordingly and resolve with the client the full extent of the engineering services and scope of work to be provided.

STUDIES

8.1 All Studies

All studies should clearly indicate the purpose for which it is intended (e.g., to support an official plan amendment; rezoning; site plan approval or establish land use compatibility, etc.)

The LEP should:

- 1) Obtain data for all relevant sound sources (transportation and stationary) suitable for completing a noise impact assessment. Road traffic data is usually available from the road authority. In some cases, traffic counts may be appropriate/necessary. Data on railway operations is usually available from the railway involved. Where possible, obtain information regarding a stationary source directly from the stationary source. This information can be obtained by the LEP or client as appropriate. Where information cannot be obtained from a stationary source, observations and appropriate assumptions should be made;
- 2) Provide a draft noise and/or vibration study to the client and, if appropriate, the other members of the design team, for review and confirmation of the accuracy of specific details of the proposed development and/or the surrounding area, prior to finalizing each study;
- 3) Include sufficient sample calculations and background information to support conclusions made;
- 4) When doing peer reviews of studies prepared by others, take into account the principles described in this document. For peer review of work prepared by other LEPs, refer to the PEO guideline *Professional Engineers Reviewing Work Prepared by Another Professional Engineer*; and
- 5) Subsequent to acoustical studies, the LEP may also be retained to assist in the preparation/review of development agreements such as condominium agreements, subdivision agreements, site plan agreements and/or offers of purchase and sale, private agreements, minutes of settlement, etc., which address noise and/or vibration assessments, required noise/vibration mitigation measures and monitoring and maintenance protocols.

8.2 Acoustic Analyses

Background data collection, acoustical monitoring/measurements, sound level predictions and analysis/assessments should be completed according to procedures that are recognized by, and are acceptable to, the MECP.

Reference should be made to any specific acoustically related policy of the land use approval authority or municipality, or other authorities (for example, as to the planning horizon date and the extent that traffic volumes should be escalated to a future date for noise analysis.)

8.3 Noise Study – Development Application

A noise study may be requested by the approval authority at one or more stages in the development approvals process. For a proposed change in land use, a noise (and vibration) feasibility study may be initially required to verify the suitability of the proposed land use and to indicate what acoustical mitigation may be required. As a development proposal progresses through the land use approvals process, the level of detail generally increases as more information becomes available regarding the proposed development and its design. Correspondingly, increasingly detailed noise assessments and reports may be required by the land use approval authority. The exact nature of details to be provided in the acoustical studies are project specific and must be determined by the LEP on a case-by-case basis, subject to the number and nature of noise and vibration sources, the environment, other development, etc. Noise studies should be prepared in accordance with the relevant requirements/guidelines of:

- 1) Ontario policies relating to land use compatibility and land development, such as the PPS and *A Place to Grow: Growth Plan for the Greater Golden Horseshoe*⁸;
- 2) Publication NPC-300 of the MECP (Ministry of the Environment, Conservation and Parks);
- 3) The D-series guidelines of the MECP;
- 4) Local municipal requirements relating to acoustics and noise control implementation;
- 5) The railways, transit authorities and the Federation of Canadian Municipalities (FCM)/ Railway Association of Canada (RAC);
- 6) Other relevant municipal, provincial and federal guidelines and requirements; and
- 7) Any standards that may be relevant to the proposed project (including, but not limited to those by CSA, ISO, ASTM, ANSI, SAE)., See Section 12.
- 8) See also Sections 8.3 to 8.5 below.

For a noise assessment, and in the preparation of a noise assessment report, the LEP should:

- 1) Review the current and future use(s) of the lands under consideration and the surrounding area; and
- 2) Conduct one or more site and/or area visits, as may be necessary in the judgement of the LEP, to observe the characteristics of the development area and nearby land uses. If a site visit is not conducted, clearly explain the reasons why a site visit was not necessary.

8.4 Noise Study - Proposed Sensitive Land Use

For a noise study in support of a development that will be a sensitive land use, the LEP should:

- 1) Identify all relevant noise sources (including stationary noise sources and transportation noise sources) that could impact the proposed development;
- 2) Identify receptors in the proposed development that may experience adverse noise effects and that should be used for the noise analysis/assessment;
- 3) Identify any factors in the surrounding area between the development and noise sources, such as topography, that can affect propagation of sound from the source(s) to the receptor(s);
- 4) Clearly identify any constraints that form part of the predictable worst-case operating condition for any relevant stationary sources;
- 5) Contact the respective regulatory bodies or access publicly available information or databases to acquire input data (e.g., road traffic information, rail traffic information, noise data from nearby industry, etc.);
- 6) Where one or more stationary sources are present, consult the MECP Access Environment or other websites or nearby industries to obtain Acoustic Summary Tables that are in the public domain;
- 7) Contact the adjacent employment/stationary source to obtain data regarding their operations. It may not be possible to obtain the data from the industry as they may not co-operate. This should be documented in the report.
- 8) Determine the applicable sound level limits at the identified receptors in the proposed development, based on its receptor class, ambient sound levels or other technical justification;
- 9) Review zoning maps for lands surrounding and nearby to the proposed development. Investigate whether there are any approved, but not constructed or are under construction, noise sources that could impact the proposed development in the future; or whether there are any development approval applications for proposed noise sources, which if approved could impact the proposed development in the future;
- 10) Consider any capital works plans or proposed future capacity increases for transportation or stationary sources to assess future operating conditions and future sound levels;
- 11) Calculate/predict the future sound levels at each receptor, from each source and the cumulative sound level where appropriate, in accordance with the applicable noise guidelines or policy. Determine the compliance status of each receptor with the applicable sound limits;
- 12) The determination of compliance should follow the principles of “predictable worst case” as defined by the MECP in NPC-300;
- 13) Where an industry has a Noise Abatement Action Plan (NAAP), its ramifications should be determined, provided this information can be obtained. Because the implementation schedule of a NAAP may have time frames of several years or more, only those portions of the NAAP that have

⁸*A Place to Grow: Growth Plan for the Greater Golden Horseshoe*, Ontario Ministry of Municipal Affairs and Housing, Office Consolidation August 2020.

been completed or are committed to being completed in the short term should be taken into account; and

- 14) Where non-compliance is found, quantify the amount of noise mitigation required to achieve compliance and land use compatibility. Recommend one or more alternative means of noise mitigation. See also Section 9 below.

8.5 Noise Study - Proposed Stationary Source

For a development that will be a (stationary) source of noise, the LEP should:

- 1) Consider any plans for future modifications at the development, as defined by the client, and the need to include these in the preparation of the noise assessment and study report;
- 2) Review zoning maps for lands within the potential area of influence of the proposed stationary source. Investigate whether there are any approved, but not yet constructed sensitive land uses that could be impacted by the proposed development in the future; or whether there are any development approval applications for proposed sensitive land uses which, if approved, could be impacted by the proposed development in the future;
- 3) Identify each receptor in all directions around the facility and their characteristics, such as type of land use (e.g., residential, day care, hospital, etc.), height (number of storeys), location of windows or other openings to the exterior, and distances from the sound (noise) sources;
- 4) Identify for each receptor any factors in the surrounding area between the facility and receptor, such as topography, intervening obstructions, etc., that can affect propagation of sound from the source(s) to the receptor;
- 5) Review operating conditions of the noise sources and select the operating scenario and emission rates that lead to the predictable worst-case scenario at the nearby receptors;
- 6) Determine the applicable sound level limit at all identified receptors, based on their receptor class, ambient sound levels or other technical justification;
- 7) Calculate/predict the future sound levels at each receptor, from each source and the cumulative sound level from the stationary source. Determine the compliance status at each receptor with the applicable sound limits;
- 8) Where non-compliance is found, quantify the amount of noise mitigation required to achieve compliance. Recommend one or more alternative means of noise mitigation to be included in the facility design for compliance and to achieve land use compatibility with other nearby land uses. See also Section 9 below;
- 9) Communicate with the client and other professionals responsible for the design of the facility, regarding the noise mitigation needed in the design and assist with the selection of mitigation concepts to be used and verify the efficacy; and
- 10) Inform the client of the need for an ECA or EASR, if applicable.

8.6 Noise Study - Proposed Multiple Use

For a proposed development that includes both sensitive land use(s) and stationary source(s), such as a hospital, industry with a daycare or an industrial mall with a place of worship, Sections 8.2, 8.3 and 8.4 also apply to the noise study.

8.7 Vibration Study – Development Application

A vibration study may be requested by the approval authority at one or more stages of the land use approval process. In some cases, the land use authority may not request a vibration study, but one is appropriate to deal with potentially adverse vibration impact on one or more receptors.

Vibration studies should be prepared in accordance with the relevant requirements of:

- 1) Ontario policies relating to land use compatibility and land development, such as in the PPS;
- 2) MECP Draft (1981) Publication NPC-207–Impulse Vibration in Residential Buildings;
- 3) MECP Publication NPC-119–Blasting;
- 4) The D-series guidelines of the MECP;
- 5) The railways, transit authorities and the FCM/RAC;
- 6) Other relevant municipal, provincial and federal guidelines and requirements; and
- 7) All relevant standards (including, but not limited to those of organizations such as CSA, ISO, ASTM, ANSI, SAE,). See Section 12.

With respect to the draft NPC-207 guideline, it should be noted that it only addresses impulse vibration. As of the preparation of this PEO guideline there is no MECP guideline for non-impulse vibration impacting people in buildings.

For a vibration assessment and the preparation of a vibration study report, the LEP should:

- 1) Review the current and future use(s) of the lands under consideration and the surrounding area; and
- 2) Conduct one or more site and/or area visits, as necessary in the judgement of the LEP, to observe the characteristics of the development area and nearby other land uses. If a site visit is not done, clearly explain the reasons why a site visit was not necessary.

8.8 Vibration Study - Proposed Sensitive Land Use

For a proposed development that will be a sensitive land use:

- 1) Identify all relevant vibration sources (including stationary vibration sources and transportation vibration sources) that could impact the proposed development;
- 2) Contact the respective regulatory bodies or access publicly available information or databases to acquire input data (e.g., rail traffic information, vibration source information from nearby industry, etc.);

- 3) Identify receptors in the proposed development that may experience adverse vibration effects and that should be used for the vibration analysis/assessment;
 - 4) Determine the applicable or recommended vibration limits at the identified receptors in the proposed development based on the source of the vibration, the type of sensitive land use, or other technical justification;
 - 5) Review zoning maps for lands surrounding and nearby to the proposed development. Investigate whether there are any approved other vibration sources that could impact the proposed development in the future or whether there are any such additional vibration sources that are not yet approved but are in the land use planning process;
 - 6) If deemed appropriate by the LEP, carry out vibration measurements at locations that, in the judgement of the LEP, are adequately representative of the future worst-case receptors. Vibration measurements should capture an adequate source operating time or number of cycles of the source operation. (For example, for railway-induced ground vibration, a minimum of five trains of each train types that use the rail line, operating at normal speed, should be measured, if possible.) For a stationary source creating vibration, such as a metal stamping plant, efforts should be made to confirm that source operations were representative of the predictable worst case during the measurements;
 - 7) Where it is not possible/feasible to measure the vibration levels, estimate/predict the future vibration levels at each receptor, from each source;
 - 8) Determine the compliance status at each receptor with the recommended vibration limits; and
 - 9) Where non-compliance is found, quantify the amount of vibration mitigation required to achieve compliance and land use compatibility. Recommend one or more alternative means of vibration mitigation. See also Section 9 below.
- 5) Determine the applicable or recommended vibration limit at all identified receptors, based on the vibration source, the type of receptor, or other technical justification;
 - 6) Estimate/predict the future vibration levels at each receptor, from each source. Determine the compliance status at each receptor with the recommended vibration limits;
 - 7) Where non-compliance is found, quantify the amount of vibration mitigation required to achieve compliance. Recommend one or more alternative means of vibration mitigation to be included in the facility design for compliance and to achieve land use compatibility with other nearby land uses, (for example, vibration isolation mounts for punch presses.) See also Section 9. below;
 - 8) Communicate with the client and other professionals responsible for the design of the facility, in respect of the vibration mitigation needed in the design and assist with the selection of mitigation concepts to be used and verify the efficacy; and
 - 9) Inform the client of the need for an ECA or EASR, if applicable.

8.9 Vibration Study - Proposed Stationary Source

For a proposed development that will be a source of vibration:

- 1) Identify each receptor in all directions around the facility and their characteristics, such as type of land use (e.g., residential, day care, hospital, etc.) and distances from the vibration sources;
- 2) Review operating conditions of the vibration sources and select the operating scenario and vibration levels that lead to the predictable worst-case scenario at the near-by receptor;
- 3) Consider any plans for future modifications at the development, as defined by the client, and the need to include these in the preparation of the vibration assessment and study report;
- 4) Review zoning maps for lands within the potential area of influence of the proposed stationary source development. Investigate whether there are any approved other vibration sensitive land uses, not yet built, that could be impacted by the proposed (stationary source) development in the future or whether there are any such additional vibration sensitive land uses that are not yet approved but are in the land use planning process;

8.10 Vibration Study - Proposed Multiple Use

For a proposed development that includes both sensitive land use(s) and stationary vibration source(s) such as a hospital or industry with a daycare, Sections 8.7, 8.8 and 8.9 apply.

9.

MITIGATION DESIGN

Typically, one or more of the noise/vibration reports discussed above will recommend the mitigation measures needed to meet the applicable or recommended guidelines, the sound and vibration limits and/or to minimize the risk of complaint, with the objective of land use compatibility. It should be noted that the proponent of the change in land use and/or the new development is solely responsible for achieving compliance and land use compatibility. While it may be more effective to mitigate at source, recommendations for mitigation at source are only appropriate where the source has agreed to implement such mitigation (including updating or amending its ECA/EASR, if necessary.)

The LEP may be asked to assist the client's team in the design and/or verification of the mitigation measures. These services may include, but not necessarily be limited to:

- 1) Determining or verifying acoustical performance requirements for building exterior envelope elements, such as sound transmission class (STC) or sound transmission loss ratings for windows and exterior walls;
- 2) Review of air conditioning or other mechanical equipment regarding sound levels and placement of the equipment;

- 3) Design of acoustic barriers. This includes the position, height, composition of the sound barrier (e.g., berm, fence or combination), and density of the materials;
- 4) Review of the grading plans to verify sound barrier requirements;
- 5) Design of the mitigation for mechanical equipment. This may include a review of sound barriers, enclosures, silencers, vibration isolators, and replacement equipment;
- 6) Review of operational parameters to ensure the guidelines/criteria can be met;
- 7) Design of vibration mitigation measures for ground-borne vibration such as from railways; structure borne-vibration from mechanical or production equipment; and recommending monitoring and maintenance protocols and procedures for implemented mitigation measures to avoid future compatibility issues over time; and
- 8) Review building permit drawings to verify that all required noise/vibration mitigation measures are properly shown, prior to applying for building permits. This typically also involves providing a confirmation document to the land use approval authority.

10.

CONSTRUCTION SERVICES

- 1) The LEP may be retained to undertake as-built construction reviews, to confirm that the as-built construction of buildings, facilities and sound barriers conform with the approved design/building permit drawings;
- 2) In some cases, confirming the performance of the noise/vibration mitigation measures may require field measurements of receptor or source sound or vibration levels and comparison to the applicable criteria/limits;
- 3) Where deficiencies in drawings or in as-built conditions are found, the LEP should notify the client and other relevant parties of such deficiencies, indicating what corrective measures are required;
- 4) When the relevant documents, drawings and/or construction are found to be complete and acceptable, the LEP will typically be required to provide written confirmation of the acceptable status; and
- 5) The LEP should provide a professional opinion on the status and should not provide any form of “certification” of construction as explained in PEO guideline *Professional Engineers Providing General Review of Construction*. Providing a “certification” expands the liability of the LEP and may invalidate professional liability insurance. The review could include a “confirmation” that the mitigation is appropriate.

11.

EXPERT WITNESS SERVICES

- 1) LEPs providing engineering services in land use planning may be retained to provide expert evidence at court and at administrative tribunal hearings where disputed land use approvals are adjudicated. In Ontario, the Ontario Land Tribunal (or similar body, because the name of the tribunal has been known to change) is the primary administrative tribunal that deals with land use planning issues. Such tribunals typically operate under the same *Rules of Civil Procedure* (rules of evidence) as do the courts.
- 2) Participation in hearings may require the preparation of witness statements, issues lists and professional opinions on acoustical matters such as noise and vibration impacts, land use compatibility, effectiveness of noise/vibration mitigation measures being proposed and whether compliance with applicable noise/vibration policies, guidelines, criteria or regulations will be met, in addition to the technical reports discussed above.
- 3) The LEP is not an advocate for the client and should provide objective, factual and opinion evidence only on matters within the competence of the LEP, namely acoustics.
- 4) Refer to the PEO guideline *The Professional Engineer as an Expert Witness* for more details.

12.

STANDARDS AND GUIDELINES

The following documents are relevant to acoustical engineering in land-use planning. This list is not comprehensive, and the documents cited are only current on the date of writing of this guideline. The LEP should be knowledgeable about all the relevant legislation, policies, regulations, technical standards, Ministry and individual municipality’s guidelines and documents that may apply or be relevant to the development under review, as listed herein and as may be amended, updated and/or added to from time to time. All guidelines/documents to be referenced should be verified as current at the time the noise/vibration study is being prepared. LEPs are advised that it is the practitioner’s responsibility to verify that the latest versions of guideline documents are being used. Further, the practitioner should be aware that there may be other associated laws, regulations, standards, or requirements (i.e., local municipal bylaws) that may apply in conducting the reviews relevant to acoustical engineering in land-use planning.

⁹ R.R.O. 1990, Reg. 194: Rules of Civil Procedure.

Provincial

1. Provincial Policy Statement Ontario Ministry of Municipal Affairs and Housing, 2020.
2. *A Place to Grow: Growth Plan for the Greater Golden Horseshoe*, Ontario Ministry of Municipal Affairs and Housing, Office Consolidation, 2020.

D-Series of Guidelines, Ontario Ministry of the Environment Conservation & Parks, including:

3. Guideline D-1 Land Use Compatibility, 1994.
4. Guideline D-1-1 Land Use Compatibility: Procedure for Implementation.
5. Guideline D-1-2 Land Use Compatibility: Specific Applications.
6. Guideline D-1-3 Land Use Compatibility: Definitions.
7. Guideline D-2 Compatibility Between Sewage Treatment and Sensitive Land Uses, 1996.
8. Guideline D-3: Environmental Considerations for Gas or Oil Pipelines and Facilities, 1994.
9. Guideline D-4 Land Use on or Near Landfills and Dumps, 1994.
10. Guideline D-4-2 Environmental Warnings/Restrictions.
11. Guideline D-4-3 Registration of Certificates and Provisional Certificates.
12. Guideline D-5 Planning for Sewage & Water Services, 1996.
13. Guideline D-6 Compatibility Between Industrial Facilities and Sensitive Land Uses, 1995.
14. Guideline D-6-1 Industrial Categorization Criteria.
15. Guideline D-6-3 Separation Distances.
16. Guideline D-6-4 MCCR Bulletin No. 91003.
17. 2009-04 Environmental Warnings and Restrictions.
18. Publication NPC-100, Model Municipal Noise Control Bylaw, Ontario Ministry of the Environment, Conservation & Parks, 1978, including, but not limited to:
 - a) Publication NPC-101—Definitions
 - b) Publication NPC-102—Instrumentation
 - c) Publication NPC-103—Procedures
 - d) Publication NPC-104—Sound Level Adjustments
 - e) Publication NPC-115—Construction Equipment
 - f) Publication NPC-118—Motorized Conveyances
 - g) Publication NPC-119—Blasting
19. ORNAMENT Ontario Road Noise Analysis Method for Environment and Transportation—Technical Document, Ontario Ministry of the Environment, Conservation & Parks, 1989.
20. STEAM (Sound from Trains Environmental Analysis Method) Sounds from Trains Environmental Analysis Method, Ontario Ministry of the Environment, Conservation & Parks, 1989.
21. Publication NPC-206: Sound Levels due to Road Traffic, Ontario Ministry of the Environment, Conservation & Parks, 1993.
22. Publication NPC-207: Impulse Vibration in Residential Buildings (Draft), Ontario Ministry of the Environment, Conservation & Parks, 1993.
23. Publication NPC-216: Residential Air Conditioning Devices, Ontario Ministry of the Environment, Conservation & Parks, 1993.
24. Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Ontario Ministry of the Environment, Conservation & Parks, 1994.
25. Guideline for Noise and Vibration Assessment of Transit Projects (Draft), Ontario Ministry of the Environment, Conservation & Parks, 2011.
26. Publication NPC-300: Environmental Noise Guideline: Stationary and Transportation Sources—Approval and Planning, Ontario Ministry of the Environment, Conservation & Parks, 2013.
27. Noise Guidelines for Wind Farms, Ontario Ministry of the Environment, Conservation & Parks, 2016.
28. Compliance Protocol for Wind Turbine Noise, Ontario Ministry of the Environment, Conservation & Parks, 2017.
29. Noise Guidelines for Landfill Sites (Draft), Ontario Ministry of the Environment, Conservation & Parks, 1998.
30. MOE/TTC Protocols (various) for Noise and Vibration Assessment, Ontario Ministry of the Environment, Conservation & Parks/Toronto Transit Corporation, 1993.
31. Environmental Guide for Noise and Vibration Impact Assessment, Metrolinx, 2020.
32. Metrolinx—GO Transit Adjacent Development Guidelines, Metrolinx, 2013.
33. MOEE/GO Transit Noise and Vibration Protocol—January 1995 (Draft #9), Ontario Ministry of the Environment, Conservation & Parks / Metrolinx, 1995.
34. Environmental Guide for Noise, Ontario Ministry of Transportation, 2022.
35. A Protocol for Dealing with Noise Concerns During the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments (the Joint Protocol), Ontario Ministry of the Environment, Conservation & Parks/Ministry of Transportation, 1986.
36. Ontario Building Code, O. Reg. 332/12, as updated or amended from time to time.
37. Builder Bulletin 19—Design and Field Review Reporting for Condominium Projects (BB19), Tarion, Feb. 1, 2021

Federal

38. Building Practice Note BPN 56: Controlling Sound Transmission into Buildings, National Research Council Canada, 1985.
39. Noise Exposure Forecast (NEF) Validation Study, National Research Council Canada, 1996, including:
 - a) Report A1505.3, Issues Related to the Calculation of Airport Noise
 - b) Report A1505.5, Review of Aircraft Noise and Its Effects
 - c) Report A-1505.6, Final Report

40. Report RR-331, Guide to Calculating Airborne Sound Transmission in Buildings, National Research Council Canada, 2018.
41. Road and Rail Noise: Effects on Housing, Canada Mortgage and Housing Corporation, 1981.
42. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise, Health Canada, 2017.
43. TP 1247E 2013/14: Land Use in the Vicinity of Aerodromes, Transport Canada, 2013.
44. National Building Code of Canada, 2020, March 2022, as updated from time to time.

Municipal/Other

45. Guidelines for New Development in Proximity to Railway Operations, Railway Association of Canada/Federation of Canadian Municipalities, 2013.
46. Transit Noise and Vibration Impact Assessment Manual, U.S. Department of Transportation – Federal Transit Administration (FTA), 2018.
47. CREATE Freight Noise and Vibration Model, U.S. Department of Transportation – Federal Railway Administration (FRA), 2006.
48. High-Speed Ground Transportation Noise and Vibration Impact Assessment Manual, U.S. Department of Transportation–Federal Railway Administration (FRA), 2012.
49. FHWA-RD-77-108, Highway Traffic Noise Prediction Model (STAMINA 2.0), U.S. Department of Transportation –Federal Highway Administration (FHWA), 1978.
50. Traffic Noise Model (TNM) Version 3.0., U.S. Department of Transportation–Federal Highway Administration (FHWA), 2020.

Standards

Canadian Standards Association (CSA) Standards on Acoustics, including:

51. Guide for the Use of Acoustical Standards in Canada, CSA-Z107.10-06.
52. Procedure for In-Situ Measurement of Noise from Industrial Equipment, CSA Z107.51 M1980, R1999.
53. Standard for Certification of Noise Barriers, CAN/CSA-Z107.9-00, R2004.
54. Recommended Practice for the Prediction of Sound Levels Received at a Distance from an Industrial Plant, CAN/CSA-Z107.55-M86, R2001.
55. Procedure for Measurement of Sound and Vibration Due to Blasting Operations, CAN3 Z107.54-M85, R2001.
56. “Wind Turbines – Part 11: Acoustic Noise Measurement Techniques”, CAN/CSA-IEC 61400-11:19, 2019.

International Organization for Standardization (ISO), American National Standards Institute (ANSI) and American Society for the Testing of Materials (ASTM) Standards on Acoustics, including:

57. Criteria for Evaluating Room Noise, ANSI/ASA S12.2-2019.
58. Acoustics–Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engi-

neering methods for an essentially free field over a reflecting plane, ANSI/ASA S12.54-2011 / ISO 3744, 2010.

59. Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure–Precision methods for anechoic rooms and hemi-anechoic rooms, ANSI/ASA S12.55-2012 / ISO 3745, 2012.
60. Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure–Survey method using an enveloping measurement surface over a reflecting plane, ANSI/ASA S12.56-2011 / ISO 3746, 2010.
61. Acoustics–Determination of sound power levels and sound energy levels of noise sources using sound pressure–Engineering/survey methods for use in situ in a reverberant environment, ANSI/ASA S12.57-2011 / ISO 3747, 2010.
62. Acoustics–Attenuation of sound during propagation outdoors–Part 1: Calculation of the absorption of sound by the atmosphere, ISO 9613-1, 1993.
63. Acoustics–Attenuation of sound during propagation outdoors –Part 2: General method of calculation, ISO 9613-2, 1996.
64. Acoustics–Determination of sound power levels of noise sources using sound intensity–Part 1: Measurement at discrete points, ISO 9614-1, 1993.
65. Acoustics–Determination of sound power levels of noise sources using sound intensity–Part 2: Measurement by scanning, ISO 9614-2, 1996.
66. Acoustics–Determination of sound power levels of noise sources using sound intensity–Part 3: Precision method for measurement by scanning, ISO 9614-3, 2002.
67. Acoustics–Description, measurement and assessment of environmental noise–Part 1: Basic quantities and assessment procedures, ISO 1996-1, 2016.
68. Acoustics–Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels, ISO 1996-2, 2017.
69. “Acoustics–Attenuation of sound during propagation outdoors–Part 1: Calculating of the absorption of sound by the atmosphere”, ISO 9613-1.
70. “Acoustics–Attenuation of sound during propagation outdoors – Part 2: General method of calculation”, ISO 9613-2.
71. Evaluation of human exposure to whole-body vibration–Part 2: Continuous and shock induced vibrations in buildings (1 to 80 Hz), ISO 2631-2, 2003.
72. Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements, ASTM E90 – 09, 2016.
73. Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings, ASTM E336-20.

APPENDIX 1. DEFINITIONS

Acoustic Audit

An Acoustic Audit is a formal assessment of the compliance of an industrial facility with its applicable provincial noise and/or vibration guidelines/conditions, conducted through measurements at representative points of reception, by an independent acoustical engineer (i.e., one not involved in the original acoustical assessment work and mitigation design).

Architectural (building) acoustics

Architectural (and building) acoustics is the applied science of generation, propagation, transmission and control of sound and vibration in and about rooms, dwellings and other buildings.

Acoustical engineer(s)

For the purposes of this guideline, acoustical engineers are defined as licensed professional engineers (licence holders of Professional Engineers Ontario), or partnerships or corporations holding certificates of authorization granted under the *Professional Engineers Act*, R.S.O. 1990, Chapter P28 who have had several years of demonstrated experience in acoustical engineering related to land-use planning. See also LEP.

Demonstrated Training and/or Experience

Demonstrated training and/or experience can be a combination of:

Successful completion of a formal course(s) which includes receipt of a written certificate, diploma, degree or equivalent;

- 1) Informal training or guidance provided by a suitable mentor such that a suitable reference could be provided; and/or
- 2) Successful completion of projects (experience) under the guidance/supervision of a suitable mentor such that examples of the completed projects would demonstrate appropriate competence.

Environmental acoustics

Environmental acoustics is the applied science of generation, propagation, transmission and control of sound and vibration in the outdoor environment.

Environmental Activity and Sector Registry

The Environmental Activity and Sector Registry (“EASR”) is a registration system operated by the Ministry of the Environment, Conservation & Parks, under the EPA, for compliance with air quality, noise and vibration requirements.

Environmental Compliance Approval

An Environmental Compliance Approval (“ECA”), formerly called a Certificate of Approval, is a permit document issued by the Ministry of the Environment, Conservation & Parks to regulated industries, according to air quality, noise and vibration requirements of the *Environmental Protection Act* (EPA).

Licensed Engineering Practitioner (LEP)

A holder of a licence from PEO and applies equally to professional engineers, temporary licence holders, and limited licence holders. For the purpose of this guideline, LEPs should have demonstrated training and/or experience in acoustical engineering related to land use planning.

Owner/client

The client is the owner or the person, or organization acting on behalf of the owner, who commissioned the work.

Receptor

Any location on a sensitive land use at which noise or vibration from any source such as road traffic, railway operations, aircraft or one or more stationary sources (industry), etc. is received; and where people could be impacted during normal activities. In NPC-300, receptors related to a stationary source are termed “points of reception”. Thus, receptor and points of reception mean the same, for all practical purposes. See Part A of NPC-300 for more details about point of reception.



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