

Implementation Review

City of Toronto Municipal Code

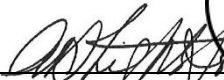
Chapter 591

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TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	SPECIAL CHARACTERISTICS OF A SOUND AND SOUND LEVEL ADJUSTMENT	2
2.1	BASIC CONCEPTS	2
2.2	QUANTITATIVE ANALYSIS – PURE TONES.....	3
2.3	QUANTITATIVE ANALYSIS – CYCLIC VARIATION.....	4
2.4	RECOMMENDATIONS.....	4
3.0	IMPULSE SOUNDS	5
3.1	DEFINITION	5
3.2	ADJUSTMENT/PENALTY.....	5
3.3	MEASUREMENT	5
3.4	CONCLUSION.....	6
3.5	RECOMMENDATIONS.....	6
4.0	DEFINITIONS.....	6
5.0	POINT OF RECEPTION.....	7
5.1	CURRENT CHAPTER 591	7
5.2	COMPARISON WITH NPC-300.....	7
5.3	COMPARISON WITH OTHER JURISDICTIONS	8
5.4	RECOMMENDATIONS.....	8
6.0	POWER DEVICES	8
6.1	CURRENT CHAPTER 591	8
6.2	EXPANDING THE DEFINITION TO INCLUDE SOURCES OTHER THAN LAWN MAINTENANCE	9
6.3	NUMERICAL LIMITS FOR POWER DEVICES	9
6.3.1	Sound Emission Limits.....	9
6.3.2	Receptor Based Sound Level Limits	10
6.4	RECOMMENDATIONS.....	10
7.0	STATIONARY SOURCES	11

.../cont'd

TABLE OF CONTENTS (continued)

7.1	COMMENTS ON CURRENT CHAPTER 591.....	11
7.2	RECOMMENDATIONS.....	12
8.0	AMPLIFIED SOUND.....	13
8.1	COMMENTS ON CURRENT CHAPTER 591.....	13
8.2	FEEDBACK FROM BY-LAW ENFORCEMENT TEAM	14
8.3	JURISDICTIONAL COMMENTS.....	14
8.4	RECOMMENDATIONS.....	15
9.0	MOTOR VEHICLES	16
9.1	CURRENT CHAPTER 591	16
9.2	CONSIDERATION OF NUMERICAL SOUND LIMITS	17
9.3	MOTOR VEHICLE SOUND MEASUREMENT PROCEDURES	17
9.3.1	Introduction.....	17
9.3.2	Automobile, Trucks And Buses	20
9.3.2.1	Test Method 1106.....	20
9.3.2.2	40 CFR Part 202, “Motor Carriers Engaged in Interstate Commerce”	20
9.3.2.3	40 CFR Part 205, “Transportation Equipment Noise Emission Control”	20
9.3.2.4	US 49 CFR Ch. III, Subpart E, Sections 325.51 - 325.59	20
9.3.2.5	ISO 362 Measurement of Noise Emitted by Vehicles	23
9.3.2.6	UN Regulation No. 51, “Uniform provisions concerning the approval of motor vehicles having at least four wheels with regard to their sound emissions.”	23
9.3.2.7	SAE J366 Exterior Sound Level for Heavy Trucks and Buses.....	23
9.3.2.8	SAE J1492 Measurement of Light Vehicle Stationary Exhaust System Sound Level Engine Speed Sweep Method	24
9.3.2.9	State of Oregon “Motor Vehicle Sound Measurement Manual”, NPCS-21, Rev. 7, 4/8/83.....	27
9.3.3	Motorcycles	27
9.3.3.1	Introduction.....	27

.../cont'd

TABLE OF CONTENTS (continued)

9.3.3.2	40 CFR Part 205, “Transportation Equipment Noise Emission Control”, Appendix I.....	27
9.3.3.3	SAE J1287 “Measurement of Exhaust Sound Pressure Levels of Stationary Motorcycles.....	28
9.3.3.4	SAE J2825.....	28
9.3.3.5	ISO 362 Measurement of Noise Emitted by Vehicles	29
9.3.3.6	UN Regulation No. 41	29
9.3.3.7	State of Oregon “Motor Vehicle Sound Measurement Manual”, NPCS-21 Rev. 7, 4/8/85.....	31
9.4	EXISTING MOTOR VEHICLE SOUND LIMITS.....	31
9.5	SUMMARY OF RECOMMENDATIONS.....	33
10.0	JURISDICTIONAL REVIEW - OTHER LARGE CITY NOISE BY-LAWS/ ORDINANCES	36
10.1	INTRODUCTION	36
10.2	NEW YORK CITY	36
10.2.1	Changes	36
10.2.2	Construction Noise (24-219-24-224).....	37
10.2.3	Stationary Sources (Section 24-232)	37
10.2.4	Amplified Sound (Commercial Music (24-331)).....	38
10.2.5	Motor Vehicles (24-236).....	38
10.2.6	Lawn Care Devices (24-242)	38
10.3	CHICAGO.....	38
10.3.1	Changes	38
10.3.2	Rules/Regulations.....	39
10.3.3	Amplified Sound and Regulated Entertainment Businesses.....	39
10.3.4	Mechanical Stationary Sources.....	39
10.3.5	Construction, Repair or Demolition Equipment.....	39
10.3.6	Catch All	40
10.4	PORTLAND, OREGON	40

.../cont'd

TABLE OF CONTENTS (continued)

10.4.1	Changes	40
10.4.2	Sound Limits (Chapter 18.10)	40
10.4.3	Motor Vehicles	41
10.4.4	Home Equipment and Powered Tools (18.10.030).....	41
10.4.5	Leaf Blowers (10.10.035).....	42
10.4.6	Construction (18.10.060)	42
10.4.7	Specific Prohibitions (18.12.020).....	42
11.0	SUMMARY OF RECOMMENDATIONS	43
11.1	SPECIAL CHARACTERISTICS OF A SOUND AND SOUND LEVEL ADJUSTMENT (SECTION 2.0).....	43
11.2	IMPULSE SOUNDS (SECTION 3.0).....	43
11.3	POINT OF RECEPTION (SECTION 5.0)	43
11.4	POWER DEVICES (SECTION 6.0).....	43
11.5	STATIONARY SOURCES (SECTION 7.0).....	44
11.6	AMPLIFIED SOUND (SECTION 8.0)	44
11.7	MOTOR VEHICLES (SECTION 9.0).....	44

LIST OF TABLES

TABLE 1	MOTOR VEHICLE SOUND LEVEL LIMITS – STATIONARY TESTS.....	32
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LIST OF FIGURES

FIGURE 1	FIGURE 2 FROM 49 CFR.....	22
FIGURE 2A	FIGURE 2 FROM UN REGULATION NO. 51, ANNEX 3.....	25
FIGURE 2B	FIGURE 2 FROM UN REGULATION NO. 51, ANNEX 3.....	26
FIGURE 3	FROM UN 41 ANNEX 3 - APPENDIX 2.....	30
FIGURE 4	ANNOTATED SAMPLE OF SOUND LEVEL TIME HISTORY.....	35

LIST OF APPENDICES

APPENDIX A TECHNICAL BACKGROUND

APPENDIX B MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TESTS

APPENDIX C JURISDICTIONAL REVIEW – CHANGES

Implementation Review

City of Toronto Municipal Code

Chapter 591

1.0 INTRODUCTION

Valcoustics Canada Ltd. (VCL) was retained by the City of Toronto Municipal Licensing & Standards (MLS) Division to review Chapter 591 of the City of Toronto Municipal Code – the “Noise By-law” and to provide technical advice, in the form of consultations and a report on a variety of specific topics involved in considering potential updates/revisions/additions.

The prime topics are:

- The practicality of addressing sounds with varying spectral, “peculiar” or “special” characteristics;
- The practicality of addressing impulse sounds;
- Options to implement a sound level limit for Motor Vehicles;
- Options to strengthen the existing sections dealing with Amplified Sound;
- The practicality of introducing and enforcing sound level limits for Power Devices;
- Best practices for sound measurements, at points of reception and at sources; and
- Update the previous (2019) review of noise by-laws (ordinances) used in New York City, Chicago and Portland, Oregon.

In addition, the scope of work included any other issues or concerns (technical or enforcement) raised by MLS staff or arising from proposed Noise By-law changes.

The Noise By-law review report is to discuss the various issues and options, make recommendations and will be submitted to the Economic and Community Development Committee and ultimately to Council. This report provides input to City staff for their preparation of the Implementation Review of the Noise By-law 2023 report.

In 2017/2018 Valcoustics was retained by MLS to review changes proposed at that time for the noise bylaw and provide technical input. Some of this previously prepared technical background information is also relevant to the current considerations. Thus, selected relevant sections of the 2018 Valcoustics report are provided again here, in Appendix A.

2.0 SPECIAL CHARACTERISTICS OF A SOUND AND SOUND LEVEL ADJUSTMENT

2.1 BASIC CONCEPTS

- 1) Generally, the impact of a sound is related to its magnitude as expressed by its sound pressure level (sound level). The higher the sound level, the higher the subjective “loudness” and the higher the potential for interference, disruption, impact, etc., in terms of aspects such as speech interference, sleep disruption, distraction, and annoyance. Below a certain sound level, which is usually found in the various sound level criteria or limits in noise bylaws, and land use planning guidelines, it is deemed that the adverse effects are minimal or nil.
- 2) If a sound has peculiar characteristics different from those of a steady, broadband sound source, such as a simple fan, there is the potential for increased disruption/annoyance, compared to a sound without such characteristics, at the same sound level.
- 3) Peculiar characteristics can be spectral, in the form of pure tones or unusual frequency components/characteristics such as hum, whine, screech, buzz. The pure tones can be a single frequency or multiple discrete frequencies.
- 4) This concept is also applied if there is cyclic variation; that is if the sound level varies up and down in a regular fashion or if there are “beats” between multiple pure tones that result in amplitude variations.
- 5) In doing a quantitative analysis to compare the magnitude of a sound in terms of sound level against a criterion or sound level limit, some guidelines such as Ontario’s NPC 104 apply an adjustment of +5 dBA to the measured sound level, and then compare to the criterion. Sometimes this adjustment is referred to as a “penalty”. This “penalty”, in effect, is making the criteria (sound limits) more stringent.
- 6) If these special or unusual qualities in a sound are readily perceptible, then increased annoyance/disruptive potential is present and the adjustment/penalty can be justified.
- 7) It should be noted that unusual characteristics such as pure tones can be easily perceptible even if this component is at a lower sound level than the overall sound or than the prevailing ambient sound level.
- 8) Because the increased disruptive/annoyance potential relates to the unusual characteristics in the sound being readily perceptible, whether the sound merits the “penalty” can be assessed subjectively by an educated listener such as a by-law enforcement officer listening to the sound and making a judgement.
- 9) There has been some suggestion that unweighted (dBZ) sound levels should be introduced into Chapter 591. For dBZ, all frequencies contribute equally to the overall sound level (including inaudible frequencies above and below the human range of hearing), unlike for dBA or dBC where some frequencies (mostly low) are given less weight (i.e., less sensitivity) to mimic the response of the human hearing mechanism at low and mid sound levels. There is no real point to introducing dBZ especially if tonal adjustments are included. Also, there is little data available for common sources, typical community sound levels nor community noise criteria in dBZ, because dBA is essentially used universally. See Appendix A for more background on the various decibel scales and frequency weightings.

2.2 QUANTITATIVE ANALYSIS – PURE TONES

- 1) To supplement the subjective assessment of pure tones in a complex sound, there are alternative quantitative methods of analysis.
- 2) Annex K of international standard ISO 1996-2-2017 (the Annex is informative and is not part of the standard) provides a simple, quantitative, “objective method for assessing the audibility of tones in noise”. Note, in our opinion, if a sound/tone does not meet these numerical criteria exactly, it does not mean that tones would not be audible nor present.
- 3) The simplified ISO method uses sound measurements in one-third octave bands. The idea is that if a one-third octave band sound level (time averaged) exceeds the sound level (time average) in both adjacent one-third octave bands by a specified amount, it can be concluded that the one-third octave band in question can contain an audible, discrete tone. The exceedance is referred to as the “constant level difference”.

For one-third octave bands in the indicated frequency ranges, the suggested potential constant level differences are:

25 to 125 Hz : 15 dB
160 to 400 Hz : 8 dB
500 to 10 kHz : 5 dB

- 4) The standard, one-third octave band center frequencies are:

20	200	2000
25	250	2500
31	315	3150
40	400	4000
50	500	5000
63	630	6300
80	800	8000
100	1000	10000
125	1250	12500
160	1600	-

The standard **octave** band center frequencies are in bold.

- 5) If the sound level in any one-third octave band exceeds that in both adjacent one-third octave bands by the specified amount, it “passes”; i.e., discrete tones should be audible. Note that in Annex K of ISO 1996-2-2017, the “constant level differences” given are qualified as “possible choices”. These are not definitive recommendations, aside from the fact that Annex K is only informative.

- 6) For one-third octave bands at the edges of a range, one would use the specified level difference for the adjacent range. For example, for the 100 Hz one-third octave band, its level must exceed that in both the 80 and 125 Hz bands by 15 dB. For the 125 Hz band it must exceed that in the 100 Hz band by 15 dB and that in the 160 Hz band by 8 dB.

Similarly, for the 500 Hz one-third octave band, it must exceed that in the 630 Hz band by 5 dB and in the 400 Hz band by 8 dB.

- 7) Note, to complicate matters, it is possible theoretically for a sound with multiple frequencies and no discrete tones to have a one-third octave band sound level well in excess of that in the adjacent one-third octave bands. This can give rise to a “false positive” result where there are no pure tones but the quantitative analysis indicates there should be.
- 8) As a further example of complexity, if a sound with an audible discrete tone at say 550 Hz, measured 5 dB higher in the 500 Hz band than the sound level in the 630 Hz band and only 6 dB higher than that in the 400 Hz one-third octave band, (rather than 8 dB), one could not categorically say there was no pure tone, especially if it was audible to the observer. Such a result of the quantitative analysis would be a “false negative” result.
- 9) Thus, some of the number crunching (quantitative analysis) can be useful to support subjective conclusions (and where the numbers are high there may not be anything to argue about). However, in some cases, marginal numbers do not mean that there is no legitimate complaint. In such cases, the subjective judgement of the by-law officer is important and should be the primary method in determining the presence of special characteristics of a sound and the application of sound level adjustments/penalties.

2.3 QUANTITATIVE ANALYSIS – CYCLIC VARIATION

If there is a cyclic variation in sound level, this should be readily apparent in a time history plot of sound level, using an appropriate time scale. Significant cyclic variations should also be readily audible subjectively.

2.4 RECOMMENDATIONS

- 1) Complicated technical quantitative methods (like those described above) of analysis of pure tones do not appear justified for purposes of enforcing a noise bylaw since simple listening to the character of a sound is considered appropriate to assess the need for adjustment/penalty. Not meeting a specific, numerical test does not guarantee that a sound with special/peculiar characteristics is devoid of the potential for increased annoyance and adverse impact.
- 2) Chapter 591 should be updated to define a subjective test that can be used to assess the need for, and application of, an adjustment/penalty for sounds with special characteristics that are more disruptive.

It should be noted that previous versions of Chapter 591 incorporated NPC-104, requiring special character adjustments as discussed above. However, at some point in the updating of Chapter 591, it was deleted. Re-introducing the concepts of NPC-104 in some form to the by-law would be consistent with existing, accepted definitions of sound characteristics that warrant a “penalty” to the measured sound levels.

3.0 IMPULSE SOUNDS

3.1 DEFINITION

Impulse sounds are those that have a very rapid increase in sound level (rise time) and last for a very short duration of time, less than one second, often for 10's or 100's of milliseconds or less. Examples of impulse sound sources are punch presses, gunshots, coupling of rail cars or trailers and tractors, riveting guns, impact wrenches, pavement breakers.

In cases of a sequence (staccato) of rapidly repeating impulse sounds, such as by a pavement breaker, the sound is termed a quasi-steady impulse sound.

3.2 ADJUSTMENT/PENALTY

In MECP guideline NPC-104, the adjustment/penalty for quasi-steady impulse sound is +10 dBA.

3.3 MEASUREMENT

The proper way to measure impulse sound is using a sound level meter with an impulse setting. A "normal" sound level meter has two selectable detector time averaging settings, Fast and Slow. Fast uses an averaging time of 125 milliseconds and Slow is 1 second. These are too long to properly indicate the true value of an impulse sound. The standardized averaging time for an impulse sound detector is 35 milliseconds. The impulse sound setting on a sound level meter responds to the fast rise time of the impulse sound because of the short detector averaging time. Because the impulse sound lasts for such a short time, the sound level reading on the meter would fall back very quickly, making it impossible for the operator to determine the impulse (peak) sound level reading. To overcome this practical problem, the standardized impulse sound level meter has a long, artificial, delay in the readout of the peak value to keep it on the display, to allow the operator to "catch" the reading. This means that if there is a sequence of impulse sounds such that subsequent impulses occur during the readout delay time, the value of these subsequent impulses cannot be read manually.

The standardized Fast and Impulse detector averaging times have been selected to respond in a manner analogous to the way human hearing works for non-impulse and impulse sounds, respectively. The Slow setting provides averaging to stabilize the reading and make it easier to read manually and has no physiological meaning.

The more sophisticated, modern sound level meters have the capability of capturing and storing in memory a time history of sound level readings. The rate of sampling of sound level typically can be selected (e.g., 5 times/sec, once/second, once/minute, etc.) If a rapid sampling rate is set and if the sound level meter is set not to the impulse setting but to measure L_{eq} over a time duration of 35 milliseconds or a time very close to 35 milliseconds, the time history will properly show all impulses, without the effects of the artificial, manual readout time delay.

Thus, where impulse sounds are involved, it is practical to easily make measurements to quantify the impulse sound levels, providing one is equipped with the appropriate instrumentation and analysis tools. For example, with a personal computer and the relevant software, a full-time history of the stored sound level readings can be plotted graphically to provide a "picture" of sound level events including impulse sounds for the full measurement period or any desired segment. Attached is a sample time history for a 12-hour period, to illustrate the "picture" of sound events obtainable. The plot can be "zoomed" to expand the time scale to obtain a more detailed view of any event.

Where multiple impulses are involved, it is appropriate to calculate the logarithmic mean impulse sound level, L_m . This is the energy averaged impulse sound level (dBAI) at the measurement point, of a group of impulse sounds, in accord with NPC-300.

3.4 CONCLUSION

Thus, assuming bylaw enforcement officers have access to the relevant instrumentation when needed, it is quite practicable to include and enforce impulse sound level limits in the noise by-law.

3.5 RECOMMENDATIONS

Consideration should be given to introducing impulse sound limits for stationary sources, based on NPC-300, including measurement techniques using impulse sound meter (setting).

4.0 DEFINITIONS

There are several definitions that should be considered for revision. A couple of suggested changes are minor, for clarification. Others are more substantive.

- **AMPLIFIED SOUND:** See Section 8.0.

Revised definitions are below.

- **CONVEYANCE & STATIONARY SOURCE:** The definition of stationary source has changed slightly from NPC-205 to NPC-300. There is no mention of Conveyances in the NPC-300 definition. To have Chapter 591 consistent with NPC-300 consider changing the definition of STATIONARY SOURCE to read "..., unless the dominant source of sound on those premises is construction.". With this revision, there no longer is a need for a definition of Conveyance and it can be deleted.
- **LARGE CRANE WORK:** The erection and dismantling of a crane or any other crane work that requires a road closure for the work to be started and finished.
- **L_{eq} :** The energy equivalent sound level is the continuous sound level that would result in the same total sound energy being produced over a given period of time as would the actually varying sound level.
- **POINT OF RECEPTION:** See Section 5.0.
- **POWER DEVICE:** See Section 6.0.
- **SOUND LEVEL METER:** There are national and international standards that define the performance requirements, in effect, defining what is a sound level meter. This should be what is used, as opposed to some totally arbitrary definition. Suggested wording: "...means an instrument that measures the sound pressure level of a sound and complies with the requirements of any of Standard's IEC 61672, IEC 60651, IEC 60804, IEC 61260, ANSI S1.4, ANSI S1.43, S1.11, as appropriate".

The definitions below are additional.

- **SOUND CALIBRATOR:** Consider adding "means an instrument for field calibrating sound level meters and complying with the requirements of standard IEC 60942 or ANSI S1.40".

- **SOUND PRESSURE LEVEL:** Consider adding a formal, technical definition since this is so fundamental to any numerical sound limits. “Also referred to as sound level (decibels); means twenty times the logarithm to the base 10 of the ratio of the of the rms (root mean square) value of the sound pressure of the sound to the reference pressure of 20 micro pascals”.

5.0 POINT OF RECEPTION

5.1 CURRENT CHAPTER 591

The current by-law contains the following stipulations with regard to a point of reception (POR).

- The location must be on a premises of a person where sound originates from another premises (the term premises is not defined in the by-law).
- The location is not limited (i.e., “any location”).
- Notwithstanding the reference to “any location”, the by-law provides a list of points of reception which include both outdoor areas (near a facade of a building, 1.5m above ground) and indoors. The wording can be interpreted to mean that these locations are the only ones available for observation, as opposed to being only examples.
- For indoor points of reception, windows and doors are assumed to be closed.

Note that the “point of reception” definition is used throughout the remainder of the by-law when specifying qualitative or quantitative prohibitions.

Prior to the 2019 revisions, the definition of “point of reception” was broader and defined only as “any point on the premises of a person where noise originating from other than those premises is received”. Specific examples were not provided, so there was no potential for limiting the available locations.

5.2 COMPARISON WITH NPC-300

The by-law definition of a point of reception varies from the NPC-300 definition of the same concept. The comparison of the current definition of POR in Chapter 591 would be against the stationary source “point of reception” definition as opposed to the transportation source “outdoor amenity area” definition (there are numerous differences in the definitions of these two concepts in NPC-300). The differences are:

- 1) NPC-300 requires that the land use be “noise sensitive” (which is also defined in NPC-300).
- 2) NPC-300 includes any outdoor location within 30m of the facade (provided the facade is a dwelling), at a height of 1.5 m above ground and includes typical (but not exhaustive) examples of back yards, front yards, etc.
- 3) NPC-300 does not include a terrace or balcony as a POR unless it is the only outdoor living area for the occupant, has a minimum depth of 4 m and is unenclosed.
- 4) NPC-300 includes the plane of windows opening into noise sensitive spaces (but not windows into non- noise sensitive spaces, such as bathrooms).

- 5) NPC-300 assumes that windows are open when evaluating sound levels at the plane of window of a noise sensitive space in a Class 1 (urban) area.
- 6) NPC-300 does not include points of reception inside a building (only at the exterior plane of the window as described above).

5.3 COMPARISON WITH OTHER JURISDICTIONS

It may be noted that the New York City noise ordinance provides not only a general definition of a “receiving property” (which is similar in scope to the City of Toronto definition prior to 2019) but also specific measurement points for different sources at a specified distance from the source (as opposed to the receptor location). For example, construction noise is measured 50 feet from the source at a point outside the property line of the construction site.

5.4 RECOMMENDATIONS

- 1) The definition should be updated to clearly state that the list of points of reception provides examples and is not intended to be exhaustive (this would be consistent with the previous sentence which states “any location”). This would align the definition more clearly with NPC-300 as outdoor points at or close to the property line would also be included.
- 2) Remove the reference to “windows and doors closed” for indoor points of reception. Open windows would be more consistent with the NPC-300 definition.
- 3) The plane of window could be added to the example list of potential points of reception (consistent with the NPC-300 concept). However, if the definition is revised back to the “any location” concept, with the elimination of the specific examples, then the plane of window would be inherently included.
- 4) As above, if the definition is revised to indicate that the list is not exhaustive, then a point at the property line would be considered part of the property and would allow a bylaw officer to measure or evaluate a complaint at the property line (without entering private property).
- 5) Leave the main definition (in the definitions section) broad (i.e., “any location”). If it is desirable to further refine points of reception for specific prohibitions, that language should be included in the individual prohibition section.

6.0 POWER DEVICES

6.1 CURRENT CHAPTER 591

At present, the definition of a power device includes a variety of pieces of equipment (chain saws, leaf blowers, gas trimmers) but limits the scope of the definition to equipment that is:

- Driven by other than muscular power (a common restriction for “power equipment” in noise bylaws); and
- Used in the servicing, maintenance, or repair of lawns.

The definition excludes equipment used to remove snow or ice. However, this provision appears incongruous as “power devices” only include equipment related to the maintenance of lawns.

According to Section 2.6 of Chapter 591:

- A. No person shall emit or cause or permit the emission of sound from a power device from 7 p.m. until 8 a.m. the next day, except until 9 a.m. on Saturdays, Sundays and statutory holidays.
- B. Subsection A does not apply to a power device used to maintain a golf course or public park or to carry out City operations including services contracted by the City.

6.2 EXPANDING THE DEFINITION TO INCLUDE SOURCES OTHER THAN LAWN MAINTENANCE

Prior to the 2019 update to the bylaw, the definition of power devices included any powered device used in the servicing, maintenance, or repair of property (excluding devices driven by muscular power and snow blowers). In terms of enforcement, it is not clear as to the limitation introduced in the 2019 revision that limits the application to lawn maintenance. For example, is it less likely that a neighbour would be annoyed by a pressure washer versus a lawnmower, assuming it was being employed outside the applicable time of day limitation? As such, it is recommended that the definition be expanded back to include all power devices with explicit protection/exemption for the following:

- Snow or ice clearing (which is currently exempted in the definition for valid reasons)
- Maintenance of a golf course or public park
- Carry out City operations included services contracted by the City
- Construction equipment
- Household power tools

6.3 NUMERICAL LIMITS FOR POWER DEVICES

As with other noise sources, the question arises as to the appropriateness of numerical limits for power devices. There are two options for numerical limits:

- i) a sound emission limit applicable to the source;
- ii) a sound limit applicable at a point of reception.

6.3.1 Sound Emission Limits

In this approach, the sound level limit is not established at the receptor location, but rather is inherent to the design and operation of the equipment. This can be in the form of a sound (pressure) level limit at a (close) distance to the source or a sound *power* level limit, which does not require a distance to be specified. In the case of leaf blowers, a standard exists for the sound measurement and labelling of equipment (ANSI Standard ANSI/OPEI B175.2-2012). The City of Vancouver uses this standard and requires that leaf blowers meet “Category 1” of the standard (≤ 65 dBA at an unspecified distance).

Beyond leaf blowers, similar standards exist for chain saws, grass trimmers, edgers, hedge trimmers, and pole pruners. As such, it may be possible to implement sound emission limits

based on the existing standards. However, in a single municipal market like Toronto (albeit a large one), it may not be practical to convince manufacturers to provide “quiet” versions of equipment meeting specified emission standards. Thus, one approach could be to reach out to other Canadian or North American municipalities to act together setting sound limits and to require sound labelling in order to use a device in the municipality. This would create a stronger incentive for manufacturers to comply. As a start, this could be done through the Federation of Canadian Municipalities, who could then reach out to its US counterpart.

Implementing sound limits for power devices would require a phased approach, with advanced notice given to manufacturers, suppliers and contractors. For example, the sound limits could begin to apply two to five years from inclusion in Chapter 591, to allow manufacturers to develop complying equipment. Using a formal sound labelling approach as per the ANSI standards would facilitate enforcement.

A further consideration could be restricting the sound emission limits to equipment used in commercial operations and not apply to household equipment. This would reduce the impact on individual residents while achieving a reduction in overall sound emissions.

6.3.2 Receptor Based Sound Level Limits

Receptor based sound level limits for power devices are much more complicated to apply compared with the current prohibition in the by-law or the sound emission labelling concept. The existing test of “no emission of sound” (outside the prescribed times of day) is easy to administer and would be expected to be easily enforceable. The by-law officer simply needs to indicate the time of day and date of the activity and whether the equipment in questions was in fact being used (in practice, there would always be some degree of “emission of sound” whenever a power device is used.). The complexities regarding points of reception and sound level limits are avoided based on the sound emission prohibition language currently in the bylaw.

Prohibiting the emission of sound during defined times (night and early morning) in effect is a (desirable) prohibition of the use of the equipment during the restricted hours, which otherwise may not be achievable in a noise by-law. (The legal basis for simply prohibiting the use may not exist.)

6.4 RECOMMENDATIONS

- 1) Revise the definition to include equipment beyond that used in lawn maintenance. This would include equipment such as pressure washers.
- 2) Consider the implementation of sound emission limits for power devices based on the existing ANSI standards. Consider the phased implementation of the sound emission limits. It is recommended that this approach be considered with the assistance of other municipalities across Canada and possibly the US. Furthermore, it is recommended that the sound emission limits for equipment apply only to commercial operations (not personal or household equipment).
- 3) It is recognized that the equipment sound emission limit and labelling concept would require considerable effort to initiate and may face considerable resistance from equipment manufacturers. However, if successful, it would be simple to enforce and achieve useful noise reduction for the community.

- 4) Ensure that the revisions continue to exempt those sources that the City wishes to exempt from the definition (see above).
- 5) The current prohibition in Section 2.6 should be retained and may still be desirable even if sound emission limits and labelling is ultimately implemented. The disadvantage of the current wording in the absence of source emission limits and labelling is that no noise reduction is achieved during the hours that the equipment is allowed to create noise (i.e., is allowed to be used) and there is no upper bound to the level of noise that can be created.

7.0 STATIONARY SOURCES

7.1 COMMENTS ON CURRENT CHAPTER 591

- 1) The current section on stationary sources is inconsistent with the provincial noise guideline.
 1. The current and applicable provincial noise control guideline dealing with stationary sources is the Ministry of Environment, Conservation and Parks (MECP) Publication NPC-300. NPC-300 is used in the land use planning process, in the approval of new noise sensitive land uses (such as residential). It is also used by the MECP in the permitting process for industries and for noise complaint investigations.
 2. NPC-300 sets the limit for stationary sources at a point of reception as the *higher* of the minimum exclusion limits or the ambient (background) sound level, typically determined by road traffic. The “exclusion” limits are a set of numerical sound levels for day, evening and night. For example, at the outdoor plane of window of a residential use, the sound “exclusion limit” values in a Class 1, urban area would be: Day or Evening 50 dBA; Night 45 dBA. If the ambient sound level were lower than the exclusion limit, the exclusion limit value becomes the limit.
 3. Section 591-2.8 deals with stationary sources of sound. Because the wording of 591-2.8 prohibits sound in excess of 50 dBA or the applicable sound limit from provincial guidelines, the sound level limit at a point of reception is effectively set as the *lower* of 50 dBA or the applicable sound level limit prescribed in provincial noise control guidelines.
 4. An inconsistency results with different sound level limits being used under Section 591-2.8 versus NPC-300. For example, if a site is close to a busy roadway which generates a significantly high ambient sound level (e.g., 60 dBA), the sound level limit in NPC-300 would be set by the ambient (i.e., the sound level limit would be 60 dBA). However, under Chapter 591, the sound level limit would default to 50 dBA, an unreasonably low limit in the context. That is, the 50 dBA limit is applicable even though the ambient is greater than 50 dBA, with the current wording.

As a further example, if the ambient is below 45 dBA, because the exclusion limit for Day/Evening is 50 dBA, there would be no inconsistency for Day/Evening; the limit would be 50 dBA. However, at Night the limit would be 45 dBA.

We surmise that this was not intended, and that it was originally thought that the most stringent sound limit within the City, including air conditioners, should be 50 dBA because of the dense urban nature.

5. The inconsistency is problematic in several ways:
 1. A new noise sensitive land use can obtain approval (e.g., zoning or site plan) based on an assessment under NPC-300, but then once built, could be immediately out of compliance with Chapter 591.
 2. Some industrial facilities require an Environmental Compliance Approval (ECA) from the MECP to operate. As part of the approval process, the MECP reviews the noise aspects relative to NPC-300. The current Chapter 591 properly exempts from Chapter 591 industrial uses that have valid ECAs. However, under Chapter 591 a facility without an ECA may be required to meet lower sound level limits than a facility with an ECA.
 3. Stationary sources were approved at the municipal level prior to 2019, when the current wording in Chapter 591 was introduced. (Prior to this, Chapter 591 only required compliance with the MECP guidelines). There are now legacy issues where some of those previously approved stationary sources may no longer be in strict compliance with Chapter 591.
- 2) The current Chapter 591 does not recognize the current full regulatory framework for provincial approvals of stationary sources under the Environmental Protection Act and thus, needs updating.
 1. As indicated above, Section 591-2.8 B. exempts a stationary source that is in compliance with a provincial Environmental Compliance Approval.
 2. As a result of changes due to O.Reg. 1/17 under the EPA, now only the heaviest of industries require an ECA. Most industries (stationary sources) now are required to register on the Ministry of Environment, Conservation and Parks Environmental Activity and Sector Registry (EASR). The technical requirements for EASR are the same as for ECA. However, the review and vetting process is different. To implement the original (and valid) intent, industries with EASR in place should also be exempt from Chapter 591, as is the case for industries with an ECA.
- 3) The By-law Enforcement team indicated a desire to introduce indoor sound level limits for stationary sources.
- 4) The current By-law groups Stationary Sources and Residential Air Conditioners in the same prohibition and applies identical language to both types of sources.

7.2 RECOMMENDATIONS

- 1) The method to determine sound level limits for stationary sources should be made consistent with NPC-300. This could be done by deleting the reference to the 50 dBA limit.
- 2) Alternatively, if there is desire to keep a lower limit of 50 dBA, the wording could be changed to

“...exceeding 50 dB(A) or the applicable sound level limit prescribed in provincial noise pollution control guidelines whichever is higher.”

- 3) Section B should include an exemption for industries that have either an ECA or EASR registration.
- 4) Indoor sound level limits could be introduced by using this general rule of thumb: in the middle of a furnished room with an open window, the indoor sound level is about 10 dBA less than the sound level outside the window. Thus, for an indoor point of reception *with windows open* (See Point of Reception Section), a reduction of 10 dBA to the minimum exclusion limits would be appropriate. That is, appropriate indoor sound level limits would be 40 dBA during the daytime and 35 dBA during the night (in terms of one-hour L_{eq}).
- 5) The prohibition for stationary sources could be separated from the prohibition for residential air conditioners such that the language of the prohibition and the reference to the specific guideline could be adjusted as appropriate. By separating the sources, the City would have more freedom in adopting specific criteria for each type of source independently.

8.0 AMPLIFIED SOUND

8.1 COMMENTS ON CURRENT CHAPTER 591

- 5) Section 591-2.1 deals with amplified sound and provides numerical sound limits for different times of day, measured at a point of reception either indoors or outdoors, over a period of 10 minutes. The specified descriptor is the A-weighted and C-weighted energy equivalent continuous sound level (L_{eq}).
- 6) This section refers to “continuous amplified sound”. The use of the term continuous is somewhat superfluous and provides less clarity. For example, if the sound lasts only 5 minutes or is intermittent, does this section of the by-law still apply? The use of the L_{eq} descriptor inherently already accounts for sound that is not continuous, is intermittent or fluctuates in amplitude.
- 7) The sound level limits are *the higher* of the existing ambient sound level at the point of reception or the numerical limits specified. Although presumably the ambient sound level would be measured in the same manner as the source, using A and C-weighted decibels with a 10-minute L_{eq} , the descriptor for ambient sound is not explicitly specified. The absence of an explicitly specified acoustic descriptor for ambient sound can potentially lead to different interpretations and varying results. Thus, being specific as to the sound descriptor would facilitate enforcement.
- 8) Section 591-2.1 sets sound limits at both indoor and outdoor points of reception. The nighttime sound level limits are 5 dB (A or C) less than the daytime limits. Both the daytime and nighttime sound level limits are somewhat lenient. As an example, the indoor limits are the same as the minimum exclusion limits that apply outdoors for stationary sources, under MECP Publication NPC-300. It is expected that in almost all cases, meeting the indoor sound level limits, would still result in the amplified sound being readily audible and potentially a nuisance.
 1. Amplified sound, and specifically music, contains information content such as beat, lyrics, varying amplitude, etc. that can make the sound more noticeable and more disturbing. MECP guidance (MECP NPC-104) would add a “penalty” to this type of source. In effect, making the sound level limits more stringent. This is the opposite of the limits used in the by-law, where the sound level limits appear to be less stringent.

Note that the introduction of a penalty for tonal or other special characteristics in a sound is recommended in Section 2.0.

2. In the case of indoors at night, the Chapter 591 sound limit values would be expected to have an adverse noise impact; for example, in terms of sleep interference for bedrooms, the current sound level limits of 45 dBA and 60 dBC at night are considered to be too high.
3. Note, rule-of-thumb: in the middle of a furnished room with an open window, the indoor sound level would be about 10 dB(A) less than the sound level outside the window. With a closed window, the difference would be 20 dB(A), or more, subject to the quality of the window. Thus, there is justification for the outdoor sound levels being higher than the indoor sound levels, by 10 dBA assuming open windows, or visa versa, the indoor sound limits should be 10 dBA lower than outside. A difference of only 5 dB(A/C) for inside and outside sound level limits means that one or the other is either too lenient or too strict.

8.2 FEEDBACK FROM BY-LAW ENFORCEMENT TEAM

1. The by-law enforcement team asked whether this section should consider complaints between residential neighbours differently than between a commercial establishment and a residential neighbour.
2. The by-law enforcement team indicated issues with various sound sources not being included within this section of the by-law while others are. For example, with music, an amplified guitar would be included but drums would not. To address this, this section should be broadened to include unamplified sound from musical instruments and similar sources such as banging on objects, whistles, etc. and not just be limited to sound sources with electronic amplification.
3. A review of the sound level limits both indoors and outdoors was requested as they are thought to be too high. It was noted that other stakeholders in the City have expressed concern with limits becoming too stringent.
4. The by-law enforcement team indicated there are occasionally issues with entering a complainant's space and thus, confirming sound levels at an indoor point of reception can be problematic. Thus, having both indoor and outdoor sound limits is desirable.

8.3 JURISDICTIONAL COMMENTS

1. The City of Chicago accounts for music and amplified sound together in the same section.
 1. The limit is stated as “average conversational level at a distance of 100 feet or more from the source (when on a public right-of-way) or property line of the property from which the noise is being generated (between 10 pm and 8 am when on a Private Open Space)”. This is interpreted as a limit of 60 dBA at a distance of 30 m. Using a sound limit defined by “average conversational level at a distance of 100 ft” is sufficiently non-specific to be open to various interpretations and is seen as making enforcement difficult.
 2. A sound level limit is provided and applies at a distance from the source, as opposed to at a defined point of reception as used in Toronto.

3. For a receptor within about 30 m (100 feet) of the source, the Chicago sound level limit is higher (less stringent) than that used in Toronto. Thus, it is seen as less useful in resolving conflicts.
 4. The above limit in 1. also applies to “Regulated Entertainment Businesses” or businesses that hold a liquor license, or a public place of amusement license. The limit applies 30 m from the property line of the source. In a dense urban environment such as downtown Toronto, a neighbouring sensitive use such as residential could be well within 30 m and could be contiguous with the source property. Thus, such an approach is seen as inappropriate for Toronto.
2. The City of New York distinguishes sound level limits for commercial music, personal audio devices and sound reproduction devices.
 1. For commercial music, the indoor, receptor sound level limits are given in three forms, all of which apply in a given situation. The limits are:
 1. an overall A-weighted sound level – cannot exceed 42 dBA;
 2. a limit in each 1/3 octave band – cannot exceed 45 dB in any 1/3 octave band between 63 Hz and 500 Hz; and
 3. and as an increase in sound level over the ambient, measured in C-weighted decibels – cannot cause a 6 dBC or more increase in sound level over the ambient.

Part of this approach is seen as potentially practicable and useful, except for item 3. Permitting a source to have a sound level in excess of the ambient is not considered desirable.

2. For personal audio devices, the subjective “plainly audible” test applies at a distance of 25 feet from the source.
3. For sound reproduction devices, the subjective, unreasonable noise test is used in general. There is also a no-audibility limitation for these devices used for commercial or business advertising purposes in any public street, sidewalk, park or place. (The original (pre-amalgamation) City of Toronto noise by-law had a prohibition of projecting sound to a public thoroughfare, with successful prosecutions of same.)

8.4 RECOMMENDATIONS

1. The word continuous should be deleted, i.e., continuous amplified sound should be changed to just amplified sound.
2. It should be stated that the ambient sound level should also be measured as a 10-minute equivalent continuous sound level $L_{eq\ 10\ mins}$, without the source, but very close in time to when the source is measured.
3. The definition of AMPLIFIED SOUND is valid and should remain. However, it would be desirable for this section to include other sources such as unamplified musical instruments such as drums or other means of producing potentially annoying sound such as banging on pails or on other materials such as metal, pipes or wood, etc. The currently proposed wording for 591-2.1 also includes for “Instrument Sound”. If this can be unambiguously interpreted to

include the above unamplified sound sources, this inclusion is appropriate and Instrument Sound should be included in the section title.

If Instrument Sound does not definitively include the above identified sound sources, an alternative could be to have the title of 591-2.1 as AMPLIFIED AND MANUALLY CREATED SOUND. This would require adding a definition of MANUALLY CREATED SOUND.

MANUALLY CREATED SOUND: Unamplified Sound created by a person or an automated mechanism playing a musical instrument such as drums, or created by moving air, as in a horn or whistle, or impacting one material by the same or other material, such as by banging on pails, pipes or pieces of metal.

4. The current A-weighted indoor sound level limits for amplified sound are the same as the MECP minimum exclusion outdoor sound level limits in an urban environment for stationary sources, i.e., 50 dBA in the day and 45 dBA at night. Given the rule of thumb indicated above for sound reduction through open/closed windows, recommendations to change the Point of Reception definition to include indoor spaces with *windows open*, and using the MECP limits as a starting point, a reduction of the indoor sound limit by 10 dB (A/C) could be warranted, i.e. to 40 dBA (55 dBC) and 35 dBA (50 dBC), day and night respectively. In a typical residence, noise would still be expected to be perceived even at these revised sound levels, but the potential impact would be less.
5. Similar to the above, the outdoor limit could be reduced to match the MECP limits. This is a 5 dB(A/C) reduction from the current limits of 50 dBA (65 dBC) and 45 dBA (60 dBC), day and night, respectively.
6. A further adjustment (penalty) of +5 dBA could also be applied to the measured sound level as a tonal adjustment/penalty for tonal or other special characteristics, where the sound is “music” or otherwise unusual.
7. If there is desire to differentiate between neighbour-on-neighbour noise and commercial music, one potential option would be to follow a similar practice as New York City. The commercial music sources could be subject to the numerical limits and the neighbour on neighbour could use the clearly audible (subjective) test, or other numerical test. The use of the clearly audible test would allow by-law enforcement officers more leeway to use subjective observations to determine violations.
8. Notwithstanding the recommendations in the Point of Reception section, the issue of available locations for observation could be addressed by using two (or more) criteria that all need to be satisfied for compliance. That is, the clearly audible or numerical limits at a point of reception could be combined with an absolute sound level at the property line of the receptor. All of which would need to be met in order to comply with the by-law.

9.0 MOTOR VEHICLES

9.1 CURRENT CHAPTER 591

- 1) The current version of Chapter 591 addresses Motor Vehicles in Section 591-2.5 and includes reasonable subjective limitations regarding unnecessary noise (591-2.5 A.) or noise during repair, modifying or testing (591-2.5 B). There are no numerical sound limits for operations.

- 2) There is a numerical sound limit (92 dBA at 50 cm from exhaust outlet) for an idling motorcycle (591-2.5 C.).
- 3) The definition of motor vehicle includes a motor assisted bicycle but excludes a power assisted bicycle. What is the difference? This definition apparently comes from the Highway Traffic Act. However, the Act has detailed definitions of both motor and power assisted bicycles. With these definitions an “e-bike” would be a power-assisted bicycle. Notwithstanding these definitions, it is somewhat confusing. Some e-bikes could potentially qualify as motor assisted.

9.2 CONSIDERATION OF NUMERICAL SOUND LIMITS

The objective is to investigate the concept of numerical sound limits for motor vehicles and consider the ramifications and practical limitations and challenges related to enforcement.

To apply numerical sound limits effectively, in practice, there must be reference to detailed, standardized sound measurement procedures; otherwise sound measurements would not be repeatable and would be meaningless.

9.3 MOTOR VEHICLE SOUND MEASUREMENT PROCEDURES

9.3.1 Introduction

- 1) A number of jurisdictions have formal, motor vehicle, sound testing/measurement procedures within legislation or regulations, to support numerical sound limits. These include Canada, the US, the UN and the state of Oregon.
- 2) National or international standards organizations such as the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO) have standardized procedures for sound measurements of motor vehicles (and other sound sources).
- 3) The Canadian Motor Vehicle Safety Regulations (MVSR) have sound emission regulations (Standard 1106) and make reference to various sound measurement procedures in relation to the various sound limits for cars, buses, trucks and motorcycles. The Canadian MVSR regulations make reference to the Canadian Test Method 1106, and to those in the US regulations (CFR), UN regulations, and SAE and ISO standards. It all can be quite bewildering.
- 4) The Canadian MVSR, Schedule V.1 incorporates several different noise emission test procedures and also provides sound level limits for various types of vehicles as determined by the identified test method. The test methods referenced are 1106; SAE J1470; ISO 362-1; US CFR 40; United Nations Regulations 41 and 51. However, all references in the MVSR are to tests of accelerating vehicles, not stationary.
- 5) There are two basic types of motor vehicle sound measurements, moving and stationary. Both require an appropriate test site and environment. Moving tests must be outdoors to be practicable. Some types of stationary tests could be indoors. Both require an appropriate environment, for example, lack of nearby sound reflecting surfaces and adequately quiet ambient sound environment, to not interfere with the sound measurements. The site for moving tests must be much larger especially considering larger vehicles such as tractor

trailers or buses. There is no need to include sound testing for these larger vehicles, if the real concern is passenger cars or motorcycles with modified exhaust systems. Nevertheless, even for testing moving passenger cars, a site of some significant size is required.

- 6) For both moving and stationary sound measurements, the site and environmental characteristics must include:
 - No sound reflecting surfaces within 50 ft (15.2 m) of microphone or vehicle;
 - No precipitation;
 - Wind less than 16 kph (10 mph);
 - Ambient at least 10 dBA below measurement sound level;
 - For moving tests, sufficient room is required for vehicle acceleration and deceleration (the basic travel path within the test zone is 101.5m (300ft)).
- 7) For moving sound tests, the procedures are somewhat complex. As an illustration, see the attached sample test procedure extracted from Canadian Test Method 1106. One of the problems is who should the driver be. If the vehicle owner, the driver will not be familiar with the test procedures and multiple repeat runs would be expected to be needed to “train” the driver. If the vehicle is to be driven by City staff who are intimately familiar with the test procedure, the staff would not necessarily be familiar with or competent to drive the vehicle. There would also be the matter of liability. Thus, it would appear that, aside from the problem of needing a qualifying test site with the necessary site conditions, moving sound tests would not be desirable or particularly practicable.
- 8) For purposes of the Toronto Noise By-law, if motor vehicle sound tests are to be done, to support numerical sound limits, the tests should be stationary.
- 9) The sound tests of interest here determine the sound levels generated when the engine is rapidly accelerated from idle to a specified engine speed, at wide open throttle with the vehicle stationary and transmission in neutral.
- 10) The various procedures for sound tests of stationary motor vehicles is similar for cars and trucks as for motorcycles.

EXAMPLE 1 MOVING SOUND TEST

Noise Emission Tests

Test Method 1106

3.3 Test Procedure

3.3.1 To determine the sound level of vehicles equipped with manual (standard) transmissions or for vehicles with automatic transmissions which can be manually held in gear, full throttle acceleration tests shall be used. An initial engine speed and associated gear ratio shall be determined for use during measurements. In this procedure, the phrase "governed engine speed" applies to vehicles which are equipped with engine speed governors, while the phrase "maximum rated engine speed" applies to vehicles which are not equipped with engine speed governors.

- (a) Select a rear axle or transmission gear ratio and initial vehicle speed such that the following conditions are met:
 - (i) Start at no more than two-thirds (66 percent) of maximum rated or governed engine speed.
 - (ii) Reach the maximum rated engine speed or governed engine speed within the test zone.
 - (iii) Do not exceed a speed of 56 km/h (35 mph) before reaching the end point.
 - (iv) Should maximum rated or governed engine speed be attained before reaching the test zone, decrease the approach rpm in 100 rpm increments until maximum rated or governed engine speed is attained within the test zone.
 - (v) Should maximum rated or governed engine speed not be attained until beyond the test zone, select the next lowest gear until maximum rated or governed engine speed is attained within the test zone.
 - (vi) Should the lowest gear still result in reaching maximum rated or governed engine speed beyond the permissible test zone, unload the vehicle or increase the approach engine speed in 100 rpm increments until the maximum rated or governed engine speed is reached within the test zone.
- (b) For the acceleration test, approach the acceleration point using the engine speed and gear ratio selection in paragraph 3.3.1(a) of this test method and at the acceleration point rapidly establish wide open throttle. The vehicle reference point shall be as indicated in subsection 3.2.8. Acceleration shall continue until maximum rated or governed engine speed is reached.
 - (i) Vehicles equipped with governed engines must be held at wide open throttle until the entire vehicle is out of the test zone.
 - (ii) Vehicles equipped with ungoverned engines must not be allowed to drop more than 100 rpm below maximum rated engine speed until the vehicle is out of the test zone.
- (c) Wheel slip which affects maximum sound level must be avoided.

9.3.2 Automobile, Trucks And Buses

9.3.2.1 Test Method 1106

Transport Canada Test Method 1106, “Noise Emission Tests”, is for showing compliance with the requirements of Standard 1106 of Schedule V.1 to the Motor Vehicle Safety Regulations. However, for exterior noise, it only covers buses greater than 4536 kg (GVWR) and the test is only for moving/accelerating vehicles.

9.3.2.2 40 CFR Part 202, “Motor Carriers Engaged in Interstate Commerce”

- 1) This US federal rule applies to motor vehicles greater than 10,000 lbs (4536 kg). It provides sound limits at 50 ft from the centerline of the travel path for two conditions: 35 mph or less and more than 35 mph (202.20). The sound limits apply under any condition of highway grade, load, acceleration or deceleration. No other details of a test procedure are provided. This rule applies to trucks and buses but not to passenger cars.
- 2) 40 CFR Part 202 also provides for a stationary vehicle sound test, measured at 15.2 m (50 ft) from the longitudinal centerline with transmission in neutral and engine accelerated from idle to maximum speed with wide open throttle. No detailed stationary sound test procedure is provided.

9.3.2.3 40 CFR Part 205, “Transportation Equipment Noise Emission Control”

- 1) This rule applies to all motor vehicles under 10,000 lbs, not including passenger vehicles, with a partially or fully enclosed driver’s compartment and to motorcycles.
- 2) This rule provides sound test procedures for both vehicles and motorcycles. The “low speed sound emission test” is a motor vehicle moving test, accelerating at full throttle, with gear ratios selected to not exceed 35 mph (205-54-1).
- 3) The test site requirements are open, flat, concrete or asphalt surface, no large reflecting surfaces within 30.4 m (100 ft) of the vehicle path or microphone.
- 4) The measurement microphone is to be 15.2 m (50 ft) of the centerline of the vehicle travel path, at a height of 1.2 m (4 ft).

9.3.2.4 US 49 CFR Ch. III, Subpart E, Sections 325.51 - 325.59

- 1) This US federal regulation provides details of a stationary motor vehicle sound emission test including test site characteristics, acceptable ambient sound and environmental conditions; measurement microphone positioning; sound level meter settings and use; vehicle operating procedure. It applies to motor vehicles greater than 4536 kg (10,000 lbs).

- 2) In this test, the vehicle remains stationary and in neutral gear and the engine is quickly accelerated to top speed from idle, with wide open throttle and then returned to idle speed, with the maximum sound level read and recorded.
- 3) The purpose is to be able to determine if the motor vehicle conforms to the sound limits in 40 CFR 202.21, the Standard for Operation under Stationary Test.
- 4) The test site does not have to be a “standard” test site, providing it is an “open” site and has certain characteristics. Figure 1 shows the standard test site. Section 325.53 (a) (2) allows the dimensions to vary.
- 5) The test site should be relatively flat with no major sound reflecting surfaces, although the presence of some objects such as fire hydrants, utility poles, rural mailboxes, traffic railings and curbs are permissible. Vertical or sloping surfaces as described in 325.53 (c) may be acceptable.
- 6) The measurement microphone is to be not less than 9.5 m (31 ft) or more than 25.3 m (83 ft) from a target point on the ground that is within 0.9 m (3 ft) of the longitudinal position of the vehicles exhaust outlet, with a preferred height of 1.2 m (4 ft). (This test procedure allows a range of microphone distances, with different sound limit criteria based on measurement distance.)
- 7) Subpart F, Sections 325.71 to 325.79 provide correction factors to be applied to the sound measurement to account for the actual microphone distance and ground surface type (acoustically hard or soft) to adjust to a standard reference distance of 15 m (50 ft).

From 49 CFR

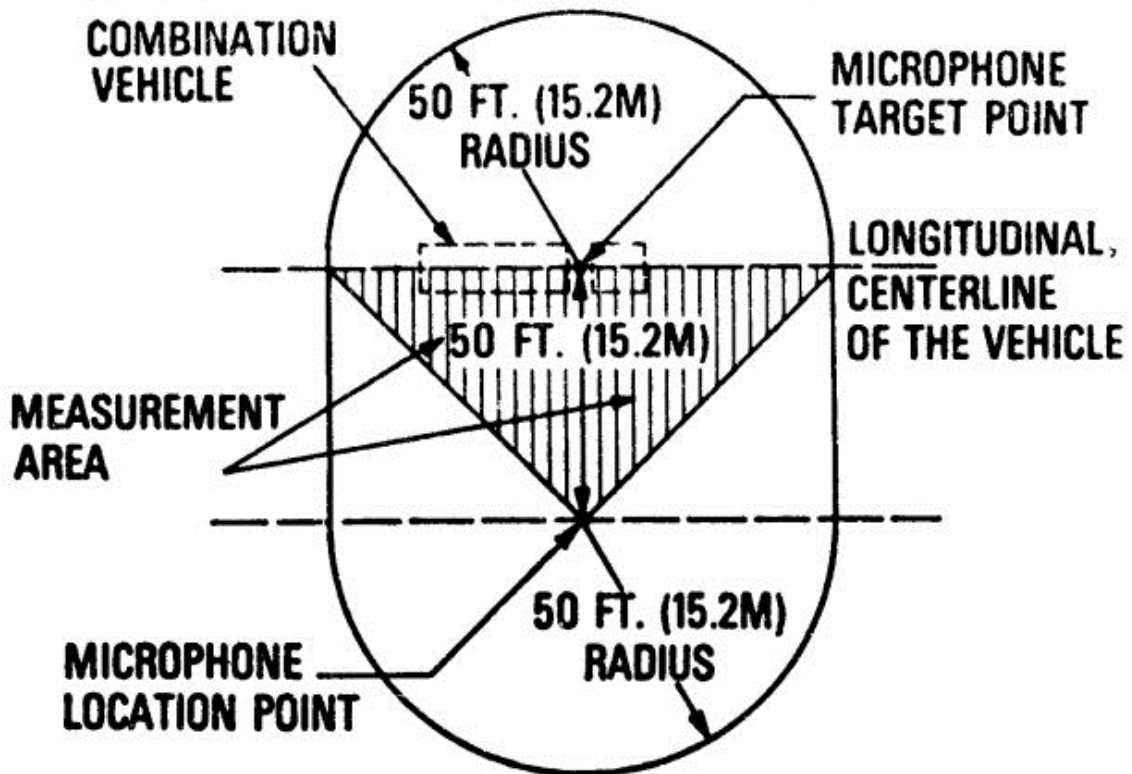


Figure 2
STANDARD TEST SITE;
STATIONARY TEST

FIGURE 1

9.3.2.5 ISO 362 Measurement of Noise Emitted by Vehicles

- 1) This document incorporates both moving and stationary sound measurement tests for both vehicles and motorcycles. The moving test involves accelerating the vehicle by rapidly going to full throttle. The stationary test is done with the engine at $\frac{3}{4}$ of the speed for maximum power (at full speed for governed engines).
- 2) The test site should be similar to that described above.
- 3) For the stationary test the microphone positions are at 7.0 m from the nearest surface of the vehicle, at a minimum of four locations around the vehicle, at a height of 1.2 m.

9.3.2.6 UN Regulation No. 51, “Uniform provisions concerning the approval of motor vehicles having at least four wheels with regard to their sound emissions.”

- 1) This regulation includes test methods for vehicles of all types in motion (constant speed and acceleration with wide open throttle) as well as for stationary vehicles. The stationary tests are in neutral gear with the engine speed above idle. See below.
- 2) Regulation No. 51 provides the characteristics/requirements of the test site and environmental conditions.
- 3) The stationary test procedure focuses on sound (noise) emission in proximity to the exhaust. The measurement microphone is to be positioned 0.5 m from the reference point of the exhaust pipe at 45° to the vertical plane of the flow axis of the end of the pipe, at least 0.2 m above the ground. See Figure 2A and 2B which shows Figures 2 and 3 from UN Regulation No. 51, Annex 3.
- 4) The engine is to be run up to a specified target speed related to its rated maximum and sound measurements done while maintaining the constant target speed for at least one second and then releasing the throttle; the sound level reading to be the maximum during this operation.

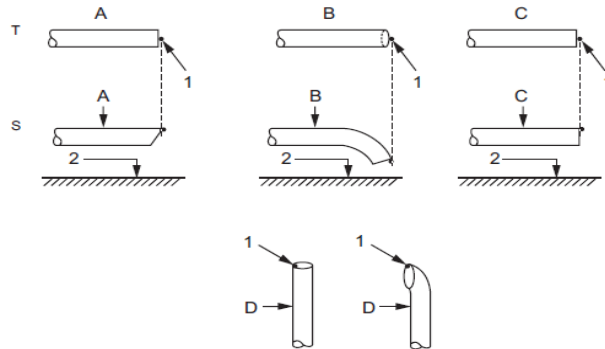
9.3.2.7 SAE J366 Exterior Sound Level for Heavy Trucks and Buses

- 1) A similar standard test for passenger cars and light trucks has been withdrawn.
- 2) The test site requirements and conditions are similar to above.
- 3) Only a moving test with full throttle acceleration is included.

9.3.2.8 SAE J1492 Measurement of Light Vehicle Stationary Exhaust System Sound Level Engine Speed Sweep Method

- 1) SAE J1492 is intended to measure the “near field” exhaust noise of light vehicles such as passenger automobiles or pick-up trucks. One use is to compare against a limit or reference value. It is not intended to determine overall, in-use, vehicle sound levels. However, it is useful where the dominant sound of an operating vehicle is from the engine exhaust.
- 2) The sound measurement location is 0.5 m from the exhaust outlet, at 45°, at the same height as the exhaust outlet and at least 0.2 m above ground.
- 3) The test site can be outdoors, with a hard surface of concrete, asphalt or equivalent with no snow, grass, loose soil, etc. and free of large sound reflecting surfaces within 3 m of the vehicle or microphone. Alternatively, a hemi-anechoic chamber of sufficient size may be used. However, this type of test site is irrelevant in the case of the City of Toronto.
- 4) The basic procedure is similar to other stationary, near field, exhaust system sound tests, such as UN Regulation No. 51, except that the engine speed is to be increased gradually from idle to the target speed over a period of 10-15 seconds, held at the target speed for at least 1 second, then the throttle rapidly released, to return to idle. Sound level readings are to be taken during this process.
- 5) The target engine speed is 50% to 75% of the (maximum) rated engine speed, depending on the rated engine speed.
- 6) This “swept speed” test has the potential to reveal resonances or other unusual characteristics in the exhaust system that may result in higher sound levels at other than the target engine speed.

From UN 51
Figure 2
Reference point for measurement of sound emitted by stationary vehicles



- Key**
 T top view
 S side view
 1 reference point
 2 road surface
 A mitered pipe
 B bent down pipe
 C straight pipe
 D vertical pipe

Figure 3a

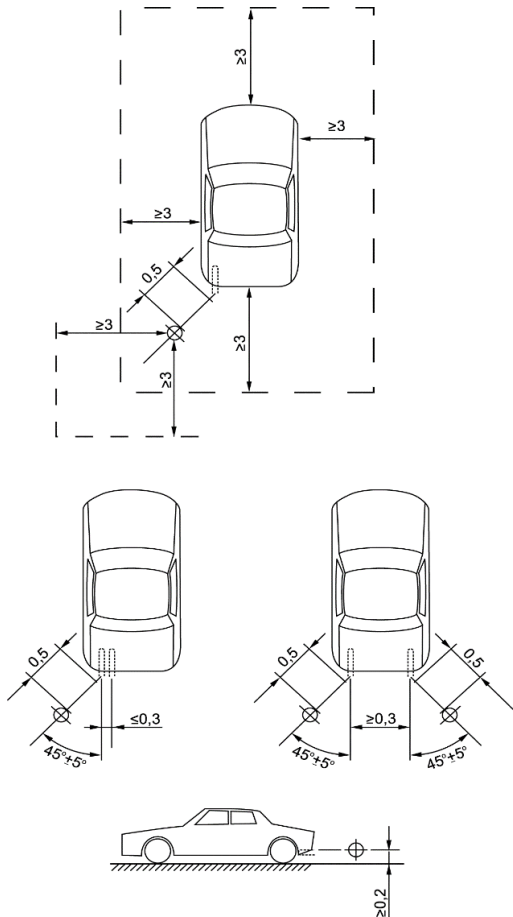


Figure 3b

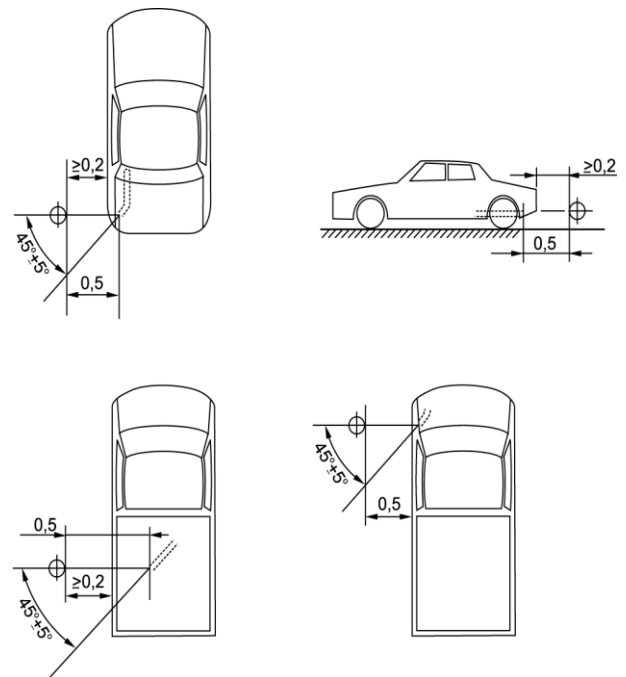


FIGURE 2A

**From UN 51
Figure 3**

Figure 3c

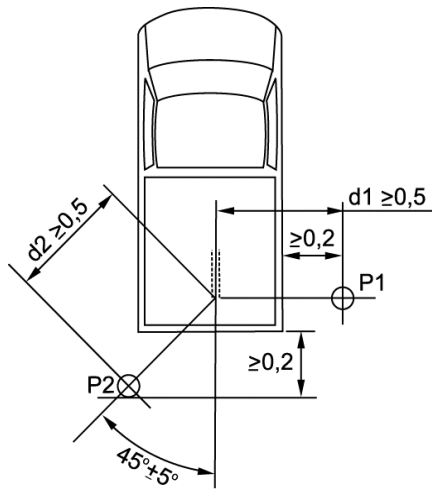


Figure 3d

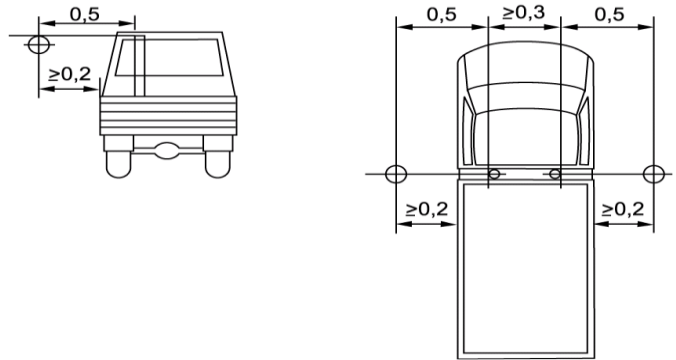


FIGURE 2B

9.3.2.9 State of Oregon “Motor Vehicle Sound Measurement Manual”, NPCS-21, Rev. 7, 4/8/83

- 1) The Oregon manual documents procedures for the measurement of sound from cars, trucks, buses, motorcycles and motorboats, including test site and environmental conditions and requirements.
- 2) Chapter 2 provides for stationary tests of trucks and buses at a distance of 25 ft.
- 3) Chapters 3 and 4 provide for moving tests of on-road motor vehicles and new vehicles, respectively, similar to 49 CFR.
- 4) Chapter 6 provides details and procedures for stationary sound tests of motor vehicles at 0.5 m (20 inches) from the engine exhaust outlet. It allows testing indoors and at sites with limited open space and can be applied to automobiles, light trucks and motorcycles.
- 5) The measurement microphone is to be 508 mm (20 inches) from the exhaust outlet, at 45° to the exhaust axis, at a height of the center of the exhaust outlet but no less than 203 mm (8 inches) from the ground surface.
- 6) The vehicle is to be stationary, in neutral gear or park, at an engine speed of 75% of that for rated horsepower.

9.3.3 Motorcycles

9.3.3.1 Introduction

- 1) The moving and stationary sound (noise) emission tests for motorcycles are similar to those for other motor vehicles.

9.3.3.2 40 CFR Part 205, “Transportation Equipment Noise Emission Control”, Appendix I

- 1) The motion test of Appendix I-1 is a full throttle acceleration test for motorcycles.
- 2) The test site must be flat and level, open, concrete or asphalt surface with no snow, soil or other extraneous material and no sound reflecting surfaces within 30 m (98.4 ft) of the microphone or the motorcycle test zone.
- 3) The measurement microphone position is 15 m (49.2 ft) from the travel path, at a height of 1.2 m (3.9 ft).
- 4) Appendix I-2 provides a comparable test procedure for moped style street motorcycles, except that the test is conducted at constant, maximum speed with full throttle.

9.3.3.3 SAE J1287 “Measurement of Exhaust Sound Pressure Levels of Stationary Motorcycles

- 1) This is a sound level test of a stationary motorcycle in neutral gear, with engine at 50% of rated maximum engine speed, measured near the engine exhaust outlet (at 0.5 m at 45°).
- 2) The test site characteristics/conditions are specified.
- 3) This test procedure is simple and was originally intended for testing of motorcycles including om-road bikes. However, due to practical difficulties in the field this is only recommended for off-road motorcycles and for on-road motorcycles is replaced by SAE J2825.

9.3.3.4 SAE J2825

- 1) SAE J2825 was introduced as an alternative to SAE J1287 for measuring exhaust sound levels of stationary, on-road motorcycles, because of difficulties encountered in implementing J1287. Three independent tests are defined; an Idle Test, a Set RPM Test and a Swept RPM Test. To identify motorcycles that exceed applicable sound limits, the Set or Swept RPM Test is recommended. SAE J2825 also provides recommended sound limits for each test procedure, based on “a comprehensive study of a wide variety of on-highway motorcycles tested with both original equipment and aftermarket exhaust systems” and correlating to sound levels obtained from the pass-by tests using the procedures in 40 CFR.
- 2) Test site conditions are defined as:
 - surface of the ground within the test area to be paved or hard packed earth level within the typical slope of a paved street or parking lot with no curbs within 0.25 m (10 inches) of the exhaust outlet;
 - an open area free of large sound reflecting surfaces such as vehicles, signboards, or buildings within 2.5 m (8 ft) of the motorcycle being tested.
- 3) All tests are with the transmission in neutral.
- 4) The idle test is at the minimum throttle setting to allow the engine to keep running for at least 5 seconds.
- 5) In the Set RPM Test, the engine is run at the specified speed for at least 2 seconds (2000 rpm or 75% of maximum speed, whichever is less, for less than 3 cylinders or more than 4; 5000 rpm or 75% of maximum speed, whichever is less, for 3 or 4 cylinders).
- 6) If a motorcycle is not able to maintain the specified engine speed for 2 seconds under no load conditions (stationary in neutral) the Swept RPM Test is to be used. The engine is slowly accelerated to the speed specified in the Set RPM Test over at least 2 seconds, at which point the throttle is released.

- 7) The measurement microphone shall be at 0.5 m (20 inches) from the exhaust outlet, at 45°, at the same height as the exhaust outlet and at least 0.2 m above ground.

9.3.3.5 ISO 362 Measurement of Noise Emitted by Vehicles

- 1) As noted earlier, this standard also includes moving and stationary sound tests for motorcycles.
- 2) The sound measurements are done at 7 m from the nearest surface of the vehicle.

9.3.3.6 UN Regulation No. 41

- 1) This regulation provides for sound measurements in both motion and stationary tests (Annex 3). The motion tests are for full throttle acceleration as well as constant speed operating conditions. The calculations related to the motion tests are relatively complex.
- 2) Annex 4 details the requirements for the test site.
- 3) The stationary test is done with transmission in neutral and the engine brought to a target speed of 50% to 75% of maximum engine speed, subject to what the maximum is. The maximum sound level is determined while bringing the engine speed up to the target speed from idle, holding it constant at the target speed for at least one second and then the throttle released.
- 4) The measurement microphone is placed 0.5 m from the exhaust pipe outlet, at 45°, at a height corresponding to the reference point on the exhaust outlet, but no less than 200 mm above the ground. See Figure 3, taken from Appendix 2 of Annex 3.

9.3.3.7 State of Oregon “Motor Vehicle Sound Measurement Manual”, NPCCS-21 Rev. 7, 4/8/85

- 1) Chapter 6, “Near Field Stationary Motor Vehicle Sound Level Measurements”, Section 6.5.5 (b) includes the operating procedure for motorcycles; transmission in neutral, with the engine stabilized at one of the defined running speeds (e.g., 50% of speed for maximum rated horsepower; 45% of “red line” speed; if specifications not available 3500 rpm if engine 950 cc or less; 2800 rpm if greater than 950 cc).
- 2) Measurement microphone position similar as for automobiles: 508 mm from exhaust outlet at 45°.

9.4 EXISTING MOTOR VEHICLE SOUND LIMITS

- 1) The various jurisdictions have sound limits for the operation of various types of motor vehicles, tied to the particular sound measurement procedure(s) specified in the regulation/rule adopted by the jurisdiction. The general objective is to set sound limits for the maximum potential sound emission under actual driving/operating conditions.
- 2) The majority of regulations/rules/test methods and sound limits apply to vehicles in motion and full throttle acceleration. Some sound tests are done at constant (maximum) speed.
- 3) As discussed earlier, a small number of regulations/rules/test methods are for stationary vehicle sound measurements with attendant sound limits.
- 4) The Canadian federal government has sound limits, in effect, at the manufacturing level, including for passenger cars, buses, trucks, motorcycles and other motor vehicles such as multi-purpose passenger vehicles. These are found in the federal Motor Vehicle Safety Regulations (MVSR), Schedule V.1, Noise Emissions (Standard 1106).
- 5) The Canadian MVSR sound limits specifically exclude stationary vehicle sound tests, in the test procedures that are referenced.
- 6) Other major jurisdictions having motor vehicle sound limits are the US federal government, the United Nations and the State of Oregon.
- 7) Table B-1 in Appendix B summarizes various sound limits, related to moving vehicle tests. This data is provided for background, although what is of primary interest here are sound limits related to stationary vehicle sound tests.
- 8) Table 1 shows the sound limits from the US federal regulations, from Oregon and from SAE J2825, based on stationary vehicle tests, for trucks, automobiles and motorcycles. Some of these sound limits apply at distances of 7.6 or 15 m. The sound limits in SAE J2825 apply at .5 m from the exhaust. Although there are other stationary source test procedures, the bulk of the sound limits relate to moving tests and there is a paucity of data related to stationary vehicle tests. UN Reg. No. 41 and 51 do not provide sound limits for the stationary tests, as the stationary test data are just used as background information for the moving tests. It is interesting to note that the City of Red Deer, Alberta uses the sound limits at 0.5 m of 92 dBA at idle and 96 dBA at higher engine speeds, for motor vehicles, apparently including cars, trucks and motorcycles (Community Standards Bylaw 3669/2021, Section 5.1).

TABLE 1 MOTOR VEHICLE SOUND LEVEL LIMITS – STATIONARY TESTS

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Distance (m)	Sound Limit (dBA)
40 CFR 202 (202.21)	>4536 kg	1986	full throttle, neutral gear	15 (50 ft)	85
49 CFR 325	≤4536 kg	–	full throttle acceleration, neutral gear	15 (50 ft)	85 (soft ground) 87 (hard ground)
Oregon OAR 340-035-0030 Table 2	autos, light trucks	all	full throttle acceleration, neutral gear	7.6 (25 ft)	95 ⁽¹⁾
Oregon OAR 340-035-0030 Table 2	motorcycles	after 1975	full throttle acceleration, neutral gear	7.6 (25 ft)	99 ⁽²⁾
SAE J1492	autos, light trucks	–	continuous sweep of engine speed, neutral gear or in park	0.5 m, 45°	not given
SAE J2825	motorcycles: all	–	idle	0.5 m, 45°	92
SAE J2825	motorcycles: less than 3 cylinders; more than 4 cylinders	–	Set RPM test Swept RPM test	0.5 m, 45°	96
SAE J2825	motorcycles: 3 or 4 cylinders	–	Set RPM test Swept RPM test	0.5 m, 45°	100
UN Reg. No. 41	motorcycles	–	neutral gear constant speed test	0.5 m, 45°	not given
UN Reg. No. 51	autos, trucks	–	neutral gear constant speed test	0.5 m, 45°	not given (given for in motion only)

(1) Equivalent to 89 dBA at 15 m.

(2) Equivalent to 93 dBA at 15 m.

9.5 SUMMARY OF RECOMMENDATIONS

- 1) It is understood that the noise from motor vehicles that is a concern relates primarily to automobiles and motorcycles that have exhaust systems that provide less sound attenuation than is otherwise practical. If the City wishes to introduce numerical sound level limits, it is recommended that the sound limits be based on stationary sound tests. The complexities and implications of moving vehicle sound tests make moving vehicle sound tests impracticable for enforcement.
- 2) As a summary, stationary motor vehicle sound test procedures are found in the following documents:
 - US 40 CFR Part 202;
 - US 49 CFR Part 325;
 - ISO 362;
 - UN Reg. No. 51;
 - SAE J366;
 - SAE J1492;
 - State of Oregon Manual NSPCS-21.

Each does not necessarily include passenger vehicles/automobiles (as opposed to trucks and buses) or motorcycles.

- 3) Stationary sound tests for motorcycles are found in:
 - UN Reg. No. 41;
 - State of Oregon Manual NPCCS-21;
 - ISO 362;
 - SAE J1287;
 - SAE J2825.
- 4) It is recommended that the stationary sound test procedure of SAE J2825 and/or UN Reg. No. 41 be adopted for motorcycles.
- 5) It is recommended that the stationary sound test procedure of SAE J1492 (or UN Reg. No. 51) be adopted for automobiles. This test is similar to and comparable to the SAE J2825 test for motorcycles in that both use a microphone measurement position at 0.5 m and 45° from the exhaust outlet.

- 6) One or more “qualifying” test sites need to be available; flat, level, paved or hardpacked surface, lack of close-by sound reflecting surfaces. In some cases, locations used by the police for “ride checks” may also qualify for stationary sound tests.
- 7) A noise screening pre-test could also be considered, to allow sound tests at non-qualifying sites that are deficient because of the presence of close-by sound reflecting surfaces such as other vehicles. The presence of reflecting surfaces would tend to increase the measured sound levels. If a vehicle passed the test under such conditions, no further steps would be required. If a vehicle failed, it could be required to have the test repeated at a designated sound test site for confirmation.
- 8) Current digital sound level meter instrumentation allows storing detailed sound level time histories so that a complete time history of a test can be printed graphically. This allows seeing the ambient sound level immediately before and after the test procedures are run, as well as the complete time history of the engine idling, run up (acceleration) and deceleration. This type of data acquisition/record keeping process should be adopted. Note, this technique is also useful to document other environmental sound sources and activity. See Figure 4 for a sample environmental sound level time history. (The time scale can be set as desired.)
- 9) To implement the stationary vehicle sound testing protocol, the City should prepare a detailed procedure document, either as a stand-alone or as a separate section in the existing training manual.
- 10) There is a lack of sound level emission information for on-road operation of automobiles and motorcycles. Based on the moving vehicle criteria in UN Reg. No. 51, the sound level limit for automobiles is in the range of 68-72 dBA at 15 m. For motorcycles, based on UN Reg. No. 41, 40 CFR 205 and the State of Oregon criteria, motorcycle sound limits at 15 m are in the range of 73 to 80 dBA, depending on engine size.
- 11) Notwithstanding that there are published procedures for stationary vehicle sound tests, those documents for tests close to the engine exhaust outlet do not all provide sound limits. The Oregon stationary test sound limits are 95 dBA for automobiles and 99 dBA for motorcycles, at 7.6 m (25 ft). It is likely that, at least for automobiles, for current vehicles, the number should be lower, because most vehicles (except motorcycles) have become quieter, using the factory-fitted exhaust systems. For sound tests close to the exhaust outlet (0.5 m) of motorcycles, SAE J2825 uses limits of 92 dBA at idle and 96 dBA at higher engine speeds.
- 12) It is currently proposed to use the above noted sound limits of SAE J2825 (92 dBA at idle and 96 dBA at other engine speeds, at 0.5m from exhaust). A database of any sound measurements done should be maintained to ascertain whether these sound limits are appropriate or whether they need adjusting to be practical and effective. The database should track the vehicle type, model, age, condition an any other relevant aspect including subjective comments about the subjective acceptability of the sound produced as a wayside listener.

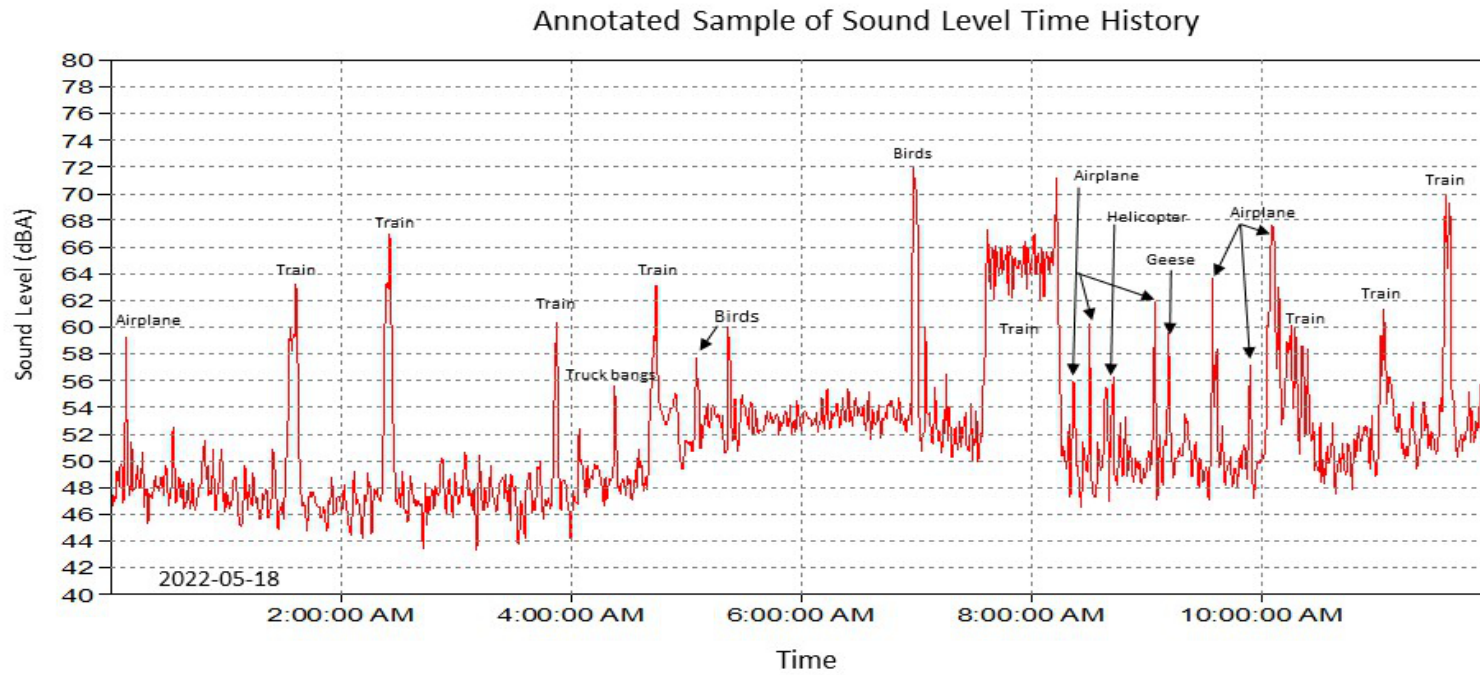


FIGURE 4

10.0 JURISDICTIONAL REVIEW - OTHER LARGE CITY NOISE BY-LAWS/ORDINANCES

10.1 INTRODUCTION

The “noise by-laws” of New York City, Chicago, and Portland, Oregon were reviewed by VCL as part of a “peer review” of proposed amendments to Chapter 591 of the City of Toronto Municipal Code. The review is documented in the report, dated October 2, 2018 (herein referred to as the previous Peer Review Report). These municipalities were chosen for comparative review because similar concerns of those of Toronto would be expected, they are of comparable size or larger, comparable complexity, and the noise by-laws/ordinances are quite comprehensive. Notwithstanding that the underlying legislative frameworks may be different, the topics covered and how they are addressed are of interest in comparison to the Toronto approach.

As is typically the case in large municipalities these “noise by-laws” have been in place for some time and have undergone revisions or additions over time. The changes to these noise by-laws/ordinances since the previous peer review report are summarized in Appendix C.

The apparent last dates of changes to the noise ordinances are:

1. New York City: Current through Local Law 2023/102, enacted July 13, 2023, included amendments effective through July 13, 2023;
2. Chicago: Current through March 30, 2023;
3. Portland: April 1, 2023.

Similar to Toronto, NYC has an Administrative Code and Chapter 2: Noise Control is referred to as the NYC Noise Control Code. Chicago has a Municipal Code and Chapter 8-32: Noise and Vibration Control is referred to as the Chicago Noise Ordinance. Portland has a City Code and the segment on noise is Title 18, Noise Control, referred to simply as Noise Control.

10.2 NEW YORK CITY

10.2.1 Changes

The majority of changes are procedural or administrative. The only “technical” changes relate to **Section 24-223 – After hours work authorization** related to construction. The basic sound limit of 85 dBA at 50 ft or more from a source, outside the property where the source is located, has been made more stringent, reducing to 75 dBA for after hours construction, when within 200 ft of a residential receptor. At further distances from a residential receptor the sound limit remains the same. The reduced sound limit does not apply if the source is street construction within 200 ft of a residential receptor. The above sound limits implicitly apply outdoors. Additionally, the sound limit is 7 dBA above the ambient, within any residential receiving property dwelling unit when any windows and doors that can affect the sound measurement are closed.

10.2.2 Construction Noise (24-219-24-224)

The NYC Charter and Administrative Code provides for promulgating rules and Section 24-219 of Title 24, Chapter 2, the Noise Control Code, requires the commissioner to adopt rules for construction noise management. These rules are prescriptive and very detailed and are Chapter 28 of Title 15 of the Rules of NYC. Examples of the rules:

- There must be a Construction Noise Mitigation Plan. If it complies with the Rules, it need not be filed with the City, but it must be posted conspicuously on the site (28-100).
- Equipment must be maintained and operated to minimize noise, have proper mufflers, keep enclosures closed, etc. Equipment not meeting specified sound limits must be replaced with quieter equipment (28-101 b. – d.)
- Vehicle idling to be minimized (28-101 e.).
- Quieter back up alarms to be used (28-101 f.).
- Sound barriers to be used (28-101 g.).
- Training program for contractor supervisors to minimize noise (28-101 h.).
- Construction to occur 7:00 AM to 6:00 PM weekdays, otherwise after-hours authorization must be obtained (28-101 k.).

In addition, there are rules for the selection and operation of specific types of equipment such as pile drivers, jackhammers/pavement breakers, earth moving equipment, dump trucks, etc. as well as characteristics of and specifications for perimeter, temporary and portable noise barriers and enclosures (28-102).

Some changes have been made to Chapter 28 since 2017. The changes are procedural and administrative.

Much of the NYC construction noise management rules are considered (by us) to be too prescriptive and detailed for use in the Toronto noise by-law. However, certain basic concepts such as having a Construction Mitigation Plan and having overall requirements to select methods and equipment to minimize construction noise could be considered. The requirement for after-hours authorization for construction outside of the permitted hours is somewhat similar to the exemption concept in the Toronto noise by-law except that in NYC construction is simply prohibited outside of normal hours unless authorized. Of course, there are noise requirements for after-hours, authorized construction.

10.2.3 Stationary Sources (Section 24-232)

The NYC noise ordinance provides sound limits in the form of octave band sound pressure limits (not overall dBA limits) for commercial or business sources such as mechanical equipment (fans, cooling towers, etc.) and assembly or manufacturing processes. The octave band sound limits apply indoors, with windows open, if possible. Separate limits are provided for residential receiving properties and commercial receiving properties (offices).

10.2.4 Amplified Sound (Commercial Music (24-331))

It appears that NYC has similar noise concerns/problems as for the entertainment district in Toronto. An interesting feature of the NYC noise ordinance is the wide discretionary power given to the commissioner to recommend no penalty or fine for a first offense, providing that permanent remediation is implemented. Also, there is discretion given to the commissioner to be able to vary the sound limits (with conditions) for individual cases. This would appear to provide an incentive for an owner of a sound/noise source to cooperate. This discretionary approach may not be acceptable in our legal system.

The NYC sound limits for music are 42 dBA or 45 dB in any 1/3 octave band (63 Hz to 500 Hz) inside a dwelling. The implicit descriptor is L_{max} , which can be very stringent (no time period is specified).

Sound reproduction for commercial or business advertising or to attract attention is prohibited in front of or via openings in buildings, on motor vehicles, at any stand or structure, on airplanes or boats or anywhere on public space where it may be heard. Incidental sound from entertainment, sporting or permitted public events is excluded.

The prohibition is somewhat similar to the prohibition of deliberately projecting sound to a public space, contained in a previous version of the Toronto noise by-law.

10.2.5 Motor Vehicles (24-236)

The sound from a motor vehicle exhaust or muffler, other than a motorcycle, of 10,000 lbs gw or less must not be plainly audible at 150 ft or more. For motor vehicles more than 10,000 lbs, the distance is 200 ft. This applies on streets with speed limits of 35 mph or less.

No ambient or other conditions are specified. This would be difficult to enforce uniformly because ambient sound can significantly affect audibility.

10.2.6 Lawn Care Devices (24-242)

Use of these devices is prohibited before 8:00 AM and after 7:00 PM or sunset, whichever is later, on weekends before 9:00 AM and after 6:00 PM or at any time such as to create unreasonable noise. Snow blowers are exempt (24-243).

10.3 CHICAGO

10.3.1 Changes

The changes made by Chicago to its noise bylaw/ordinance are primarily procedural or administrative. For example, Section 8-32-060 lists the designated noise sensitive zones; Section 8-32-080 adds an exception for outdoor entertainment venues between 10:00 AM and 10:00 PM. The one “technical” amendment appears to be to the definition of “Noise Disturbance”: now “any sound which is audible at a distance of 600 feet or more from the source”; whereas before it was “sound exceeding 70 dBA on the public way when measured at 10 feet or more from the source”. The new definition is likely more difficult to interpret/implement/enforce in a dense urban area.

10.3.2 Rules/Regulations

The Chicago noise ordinance allows the superintendent of police to make regulations regarding aspects in the by-law that have subjective criteria (Section 8-32-030). Mechanical stationary sources (Section 8-32-090) have numerical limits: 55 dBA at 100 ft or more from the source or 70 dBA at 10 ft or more from the source as measured from the nearest adjacent public way or nearest adjacent property, whichever is closer to the source.

10.3.3 Amplified Sound and Regulated Entertainment Businesses

- 1) On a public way, amplified sound must not be louder than average conversational level at 100 ft or more horizontally or vertically (Section 8-32-070). “Average conversational level” is defined as a level at which normal, unamplified speech is clearly and distinctly audible above ambient noise level. This is clearly a subjective criterion that can vary depending on the ambient circumstances.
- 2) Excluded from 8:00 AM to 10:00 PM are parades, athletic events, public assemblies or special events, all of which may need a permit, providing the source is in compliance with the permit (Section 8-32-070 (c)).
- 3) Regulated Entertainment Businesses are licensed places of amusement or establishments with a liquor license (Section 8-32-080).
- 4) The sound limit is for amplified sound not to be louder than average conversational level at 100 ft or more from the property line of the property on which the noise is generated (Section 8-32-080 (a)). This is consistent with the limit for amplified sound in Section 8-32-070.
- 5) This sound limit criterion can be expected to be difficult to enforce and also potentially inappropriate in a dense urban area when a sensitive receptor is less than 100 ft from an amplified source.

10.3.4 Mechanical Stationary Sources

- 1) Quantitative sound limits apply to mechanical equipment such as fans, cooling towers, air conditioning compressors, etc.: 55 dBA at 100 ft or more from the source or 70 dBA at 10 ft or more, measured at the nearest public way or nearest adjacent property, whichever is closer (Section 8-32-090). Generally applies 8:00 PM to 8:00 AM. This approach is consistent with the other quantitative criteria in the Chicago noise ordinance.

10.3.5 Construction, Repair or Demolition Equipment

- 1) No sound limits are provided (Section 8-32-140). The use of powered mechanical equipment or tools, construction, repair, and demolition are simply prohibited between 8:00 PM and 8:00 AM within 600 ft of any residential building or hospital. Emergencies and public projects are exempted.
- 2) There seems to be no provision for long concrete pours that cannot be interrupted.

10.3.6 Catch All

- 1) For any noise source not otherwise specifically addressed, the sound limit for any noise generated on the public way is that it must not be louder than average conversational level at 100 ft or more, vertically or horizontally or if generated on private open space at 100 ft or more measured from the property line of the property on which the sound is generated (Section 8-32-150). This applies between 8:00 PM and 8:00 AM.

10.4 PORTLAND, OREGON

10.4.1 Changes

The changes made by Portland are procedural or administrative.

10.4.2 Sound Limits (Chapter 18.10)

- 1) Basically the sound level limits apply to all sources. However, the sound level limits vary as a function of both the land use type of that of the receptor as well as of the land use zone of the source. The sound limits apply at the property line; outdoors.
- 2) For example, for a source in a Residential zone and the receptor in a Residential zone the daytime limit is 55 dBA. However, if the source is in an Industrial zone (receptor in Residential zone), the limit is 65 dBA. Figure 1 in the Portland noise ordinance gives a matrix of permissible sound levels for each combination of source and receiver land use zones (18.10.010 A.).
- 3) The permissible sound levels decrease by 5 dBA for night (10:00 PM to 7:00 AM), compared to day (7:00 AM to 10:00 PM) (18.10.010 B.1.).
- 4) The sound level is an instantaneous value, in dBA, on the fast setting of the sound level meter unless otherwise instructed by the Noise Control Officer (18.04.020 E.).
- 5) At any time, a steady sound or narrowband sound must meet a limit reduced by 5 dBA (only 1 adjustment) (18.10.010 B.2.). This adjustment for narrowband sound is analogous to the tonal penalty concept used in Ontario (MECP guideline NPC-300).
- 6) Impulse sound limits are 100 dBA during day and 80 dBA during night measured as “peak sound pressure level”, with peak undefined (18.10.010 F.). Impulses are to be measured unweighted on a peak reading instrument (18.04.040 K.). While some sound level meters have an impulse setting, few if any provide true peak sound pressure levels.
- 7) If a dwelling or receiver is in a non-residential zone, the limit for that type of zone applies, unless the residential/sensitive receptor predates the source, in which case the sound limit is increased by 5 dBA at the lot line (18.10.010 C.2.).
- 8) Where the Noise Control Officer finds that the frequency characteristics of a sound are such that an A-weighted (dBA) reading is inadequate to protect the public, octave band sound level measurements shall be used and compared against the maximum octave band sound levels given in Figure 2 (18.10.010 G.).

10.4.3 Motor Vehicles

- 1) There are a number of qualitative noise control measures for the operation of motor vehicles specified, such as requiring a muffler in good working order; no exhaust system cutout, bypass or similar device; no squealing or screeching because of excessive speed; no dynamic braking device in use within 200 ft of a dwelling, school or hospital, etc.
- 2) Federal regulation 40 CFR, Part 202 is incorporated. This applies to trucks of 10,000 lbs or more GCWR. It sets a sound emission limit for a moving vehicle of 83 dBA at 50 ft from travel lane center line as measured on an open site with fast meter setting at 35 mph or less and sets a limit of 87 dBA above 35 mph (202.20).
- 3) 40 CFR, Part 202.21 sets a sound limit of 85 dBA for a stationary vehicle, at 50 ft from the longitudinal center line of the truck, on an open site, fast meter setting, when accelerated from idle to wide open throttle to governed speed.
- 4) Also incorporated is the Oregon Department of Environmental Quality, Chapter 340, Division 35, Noise Control Regulations OAR 340-035-030, Noise Control Regulations for In-Use Motor Vehicles. This applies to all vehicles less than 10,000 lbs GCWR, including motorcycles and off-road recreational vehicles, as well as auxiliary equipment driven by the primary engine. This regulation includes tables of sound limits for each vehicle category.
- 5) The State of Oregon has prepared technical manuals for the measurement of environmental sound (noise), "Sound Measurement Procedures Manual", NPCS-1, and for measurement of motor vehicle sound emissions, "Motor Vehicle Sound Measurement Procedures Manual", NPCS-21, both referenced in OAR 340-035-030. The motor vehicle sound measurement procedures encompass both moving and stationary sound measurements.
- 6) More specifics of the Oregon motor vehicle sound limits are found here-in in the section "Motor Vehicles".

10.4.4 Home Equipment and Powered Tools (18.10.030)

- 1) This applies to powered tools and equipment for home use, including lawn and garden maintenance, except leaf blowers which are addressed separately.
- 2) When used inside a dwelling between 7:00 AM and 10:00 PM, the sound limit at the lot line is 60 dBA (18.10.030 B.).
- 3) When used outside between 7:00 AM and 10:00 PM, at 25 ft (7.6 m) or at the lot line, whichever distance is greater, the sound limits are:
 - 5 Hp or less (e.g., lawn mowers, tractors, etc.): 80 dBA;
 - More than 5 Hp: 85 dBA (18.10.030 C.).
- 4) When used between 10:00 PM and 7:00 AM, the sound limits are those given above in the section (18.10.010) giving sound limits for various land use zones (18.10.030 D.).
- 5) Tools and equipment used for a home occupation have a sound limit at the lot line of 50 dBA, anytime (18.10.030 E.).

10.4.5 Leaf Blowers (10.10.035)

- 1) Includes blowers and vacuums.
- 2) Operating a leaf blower in Commercial/Mixed-Use, Industrial, Open Space zones, or adjoining public rights-of-way between 9:00 PM and 7:00 AM, seven days a week are prohibited unless the requirements and the overall (dBA) sound limits of the land use zones section (18.10.010 A. – F., H.) are met (18.10.035 B.1.).
- 3) Operating a leaf blower in a Residential Zone or in an adjoining public right-of-way is prohibited between 7:00 PM and 7:00 AM, seven days a week.
- 4) The Noise Control Officer is required to create and maintain lists of leaf blowers that are certified by a third party using the ANSI Standard B175.2-2000 to not exceed 65 and 70 dBA at 50 ft (18.10.035 C. 1. and 2.).
- 5) From March 1 to October 31 using a leaf blower which is not on the list of those rated at 65 dBA or less is a violation (18.10.035 3.).
- 6) From November 1 to February 28 using a leaf blower which is not on the lists of those rated at 70 dBA or less is a violation (18.10.035 4.).
- 7) Leaf blowers used on Open Space land use zones at 200 ft or more from the property line must be rated at no more than 75 dBA.

10.4.6 Construction (18.10.060)

- 1) The sound limit for equipment is 85 dBA at 50 ft (15.2 m), not including trucks, pile drivers, pavement breakers, scrapers, concrete saws and rock drills (18.10.060 A.).
- 2) From 6:00 PM to 7:00 AM and from 6:00 PM Saturday through to 7:00 AM Monday and on legal holidays, the permissible sound levels in the appropriate land use zones section (18.10.010) apply to all construction activities unless an emergency or a variance has been granted. The exempted equipment in Section 18.10.060 A. above is not exempted in these hours (18.10.060 B.).
- 3) Pile drivers operated from 6:00 PM to 8:00 AM and from 6:00 PM Friday through to 8:00 AM Monday and on legal holidays must meet the sound limits of the appropriate land use zones section (18.10.010).

10.4.7 Specific Prohibitions (18.12.020)

- 1) There are prohibitions on noise disturbances by animals, sound producing or reproducing equipment (amplified sound) and parked trucks (10,000 lbs GCWR).
- 2) With respect to sound producing/reproducing equipment, causing a noise disturbance is prohibited as is operating between 10:00 PM and 7:00 AM so as to be plainly audible within any dwelling not containing the source. Also prohibited is operating any such device on public property/right-of-way so as to be plainly audible at 100 ft or more from the source (18.12.020 B.).

11.0 SUMMARY OF RECOMMENDATIONS

11.1 SPECIAL CHARACTERISTICS OF A SOUND AND SOUND LEVEL ADJUSTMENT (SECTION 2.0)

1. Include tonal and special sound character adjustments (penalty) based primarily on a qualitative (subjective) assessment.
2. A simple numeric procedure for tonal character as in Annex K of ISO 1996-2 could be used as a secondary/backup assessment.

11.2 IMPULSE SOUNDS (SECTION 3.0)

3. Introduce sound limits for impulse sounds, and measurement procedures, as per NPC-300.

11.3 POINT OF RECEPTION (SECTION 5.0)

4. Update the definition to clearly state that the itemized list is only a list of examples and is not exhaustive.
5. Remove the reference to “windows and doors closed” for indoor points of reception.
6. Add “Plane of noise sensitive Windows” to the list of POR examples.
7. As above, add a “point on the property line” to the list of examples.
8. Additional refinements regarding points of reception can be added in the individual prohibition sections, if desired.

11.4 POWER DEVICES (SECTION 6.0)

9. Revise the definition to include equipment beyond that used in lawn maintenance. This would include equipment such as pressure washers.
10. Consider the implementation of sound emission limits for power devices based on the existing ANSI standards.
 - Phased implementation over time to allow for adoption;
 - Coordinate with other municipalities if possible;
 - Emission limits for equipment would apply to commercial operations only.
11. Continue to exempt those sources that the City wishes to exempt from the definition.
12. Maintain the current time of day prohibition (no emission of sound) and apply it to the broader definition of “power devices” as recommended above.

11.5 STATIONARY SOURCES (SECTION 7.0)

13. Inconsistencies between Chapter 591 and the current provincial noise guideline, Publication NPC-300, should be resolved. It is recommended that the method to determine sound level limits for stationary sources and the sound limits be made consistent with NPC-300.
14. The exemption for sources with provincial approvals should be expanded to recognize the full regulatory framework. Section B of 591-2.8 should include an exemption for industries that either have an Environmental Compliance Approval (ECA) or an Environmental Activity and Sector Registry (EASR).

11.6 AMPLIFIED SOUND (SECTION 8.0)

15. Other sound sources such as unamplified musical instruments (e.g., drums) should be included with Amplified Sound. This will require a title change to, for example, Amplified Sound and Other (Manual) Sound Sources.
16. The sound descriptor should be 10 min L_{eq} (L_{eq10}). The sound source should not be qualified as “continuous”.
17. It is recommended that the sound level limits, both indoors and outdoors, be revised to be lower.
 - The indoor sound level limits are recommended to be 10 dB(A/C) lower than current. The limits would be 40 dBA (55 dBC) during the daytime and 35 dBA (50 dBC) during the nighttime.
 - The outdoor sound level limits are recommended to be 5 dB(A/C) lower than current. The limits would be 50 dBA (65 dBC) during the daytime and 45 dBA (60 dBC) during the nighttime.
18. The use of a further adjustment (penalty) of +5 dBA, to account for tonal or other special characteristics, is also recommended.
19. A differentiation between neighbour-on-neighbour noise and commercial music could be added by using the numerical limits for commercial music sources and the clearly audible (subjective test) for neighbour-on-neighbour noise.

11.7 MOTOR VEHICLES (SECTION 9.0)

20. To introduce numerical sound limits for automobiles and motorcycle, stationary sound tests of sound emission from engine exhaust, at close distance should be used, based on test procedures of SAE J1492, J2825, UN Reg. No. 51 and 41.
21. If possible, one or more “official” test sites should be identified.
22. Noise “screening” test procedures that can be used other than at formal test sites should be considered for inclusion.

23. Sound limits for all motor vehicles, including motorcycles, are proposed as 92 dBA at idle and 96 dBA at any other engine speed, as measured at 0.5 m from the exhaust outlet. Because there is little data available for sound measurements under these conditions, a database of sound measurements made should be established to verify the suitability of these criteria and to adjust the criteria if needed. The opportunity to do sound measurements of vehicles considered acceptable from the point of view of noise should be taken.

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APPENDIX A

TECHNICAL BACKGROUND

APPENDIX A

TECHNICAL BACKGROUND

A1.0 BASIC SOUND LEVEL METRICS

A1.1 THE DECIBEL

Sound is a form of energy, manifested as variations in air pressure in the atmosphere. The energy is proportional to the air pressure squared. The range of pressure to which the human ear responds is very large; 1,000,000:1. To handle such a large range of numbers and because all biological systems respond to input stimuli in a non-linear fashion, the (energy) magnitude of a sound is measured on a logarithmic scale using decibels (dB). Mathematically, sound pressure level of a sound (often just sound level) is defined as:

$$\text{SPL} = 10 \log \left(\frac{P_1^2}{P_0^2} \right), \text{ decibels, where } P_1 \text{ is the pressure of the sound in Pascals and } P_0 \text{ is the reference pressure of } 20 \times 10^{-6} \text{ Pascals which is the threshold of hearing.}$$

Figure A-1 shows the range of sound levels and some example source sound levels.

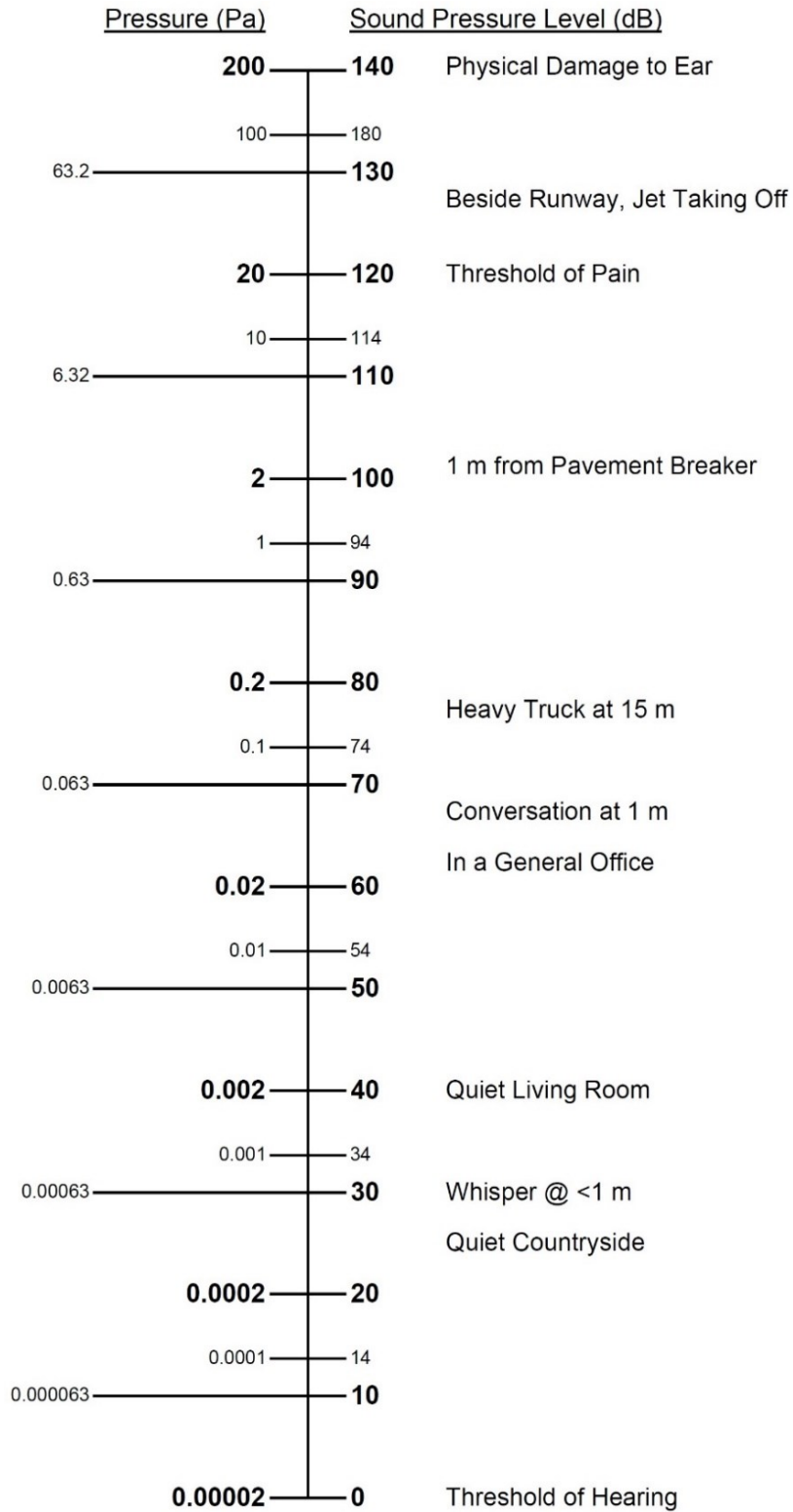


Figure A-1: Typical Sound Pressures and Levels

A1.2 FREQUENCY RESPONSE

The human hearing mechanism generally can hear the range of frequencies from 20 Hz to 20,000 Hz. The human hearing mechanism is not equally sensitive to all frequencies across the audible spectrum. We are most sensitive in the mid-range with somewhat lower sensitivity to higher frequencies and significantly lower sensitivity to lower frequencies. Figure A-2 shows the “classical” equal loudness contours for human hearing. The horizontal scale (abscissa) is frequency. The vertical scale (ordinate) is sound pressure level. Each curve represents sounds of equal loudness (at different frequencies), i.e., constant loudness level. This clearly shows that at low frequencies (e.g., 100 Hz and lower) it requires significantly higher sound level to create a sound that appears equally loud as a mid frequency sound such as at 1000 Hz. The curves flatten out as the loudness level increases, indicating that the differences in sensitivity at different frequencies reduces at higher sound levels.

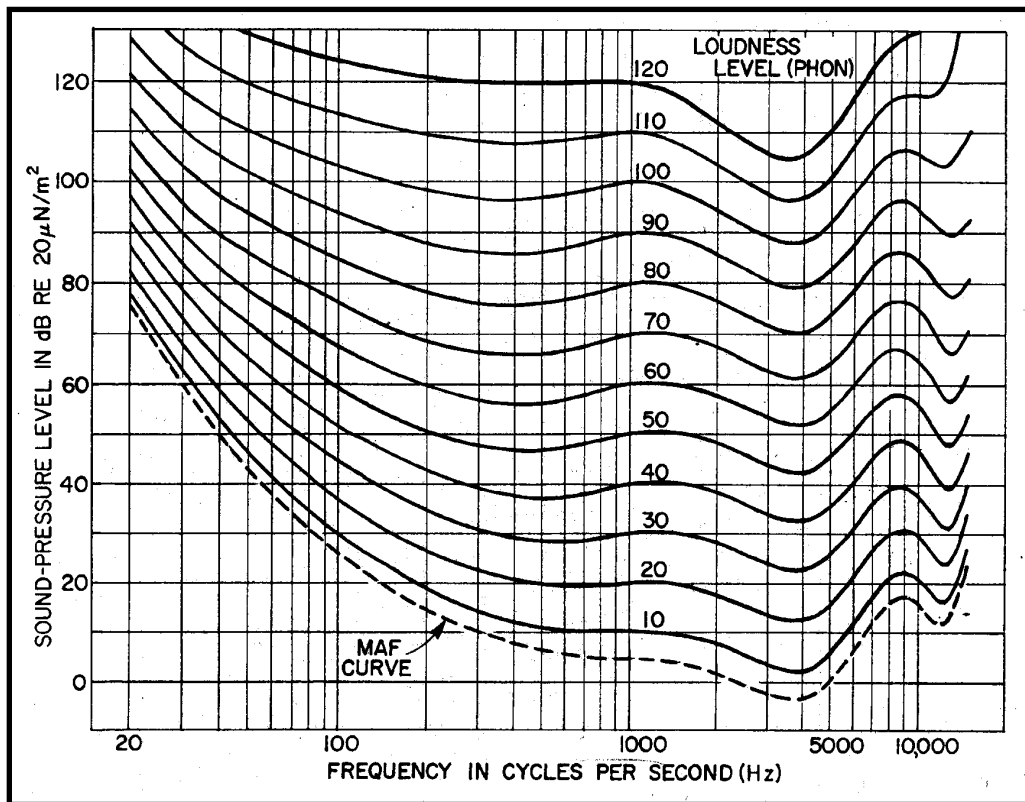


Figure A-2: Human Equal Loudness Contours

A1.3 FREQUENCY WEIGHTING NETWORKS

As seen in Figure A-2, the human hearing mechanism is less sensitive to lower frequencies and to a lesser extent to higher frequencies, compared to the mid frequencies (around 1000Hz). For making sound measurements it is often desirable for the sensitivity of the sound level meter at different frequencies to be similar to that of the human ear so that the measured value more closely reflects the way we hear.

For this purpose, sound level meters incorporate frequency “weighting” networks that give the electronic circuit a frequency sensitivity contour that is the inverse of an equal loudness contour. See Figure A-3. These weighting networks are standardized formally by national and international standards. The most commonly used for community sound (noise) measurements is “A-weighting” which has the approximate shape of the inverse of the 40 phon equal loudness contour. With this weighting, the low frequencies are de-emphasized as are the higher frequencies to a lesser extent. A-weighted sound pressure levels are referred to as A-weighted decibels, abbreviated dBA. The A-weighted decibel is the base metric used in the City of Toronto Noise By-law, elsewhere in noise bylaws, in the MECPC noise guidelines and internationally for community noise. C-weighting which approximates the 100 phon equal loudness contour is another commonly used weighting and is also referenced in City of Toronto Noise By-law. This contour is much “flatter” and does not deemphasise the low frequencies as much as the A-weighting network. There are other weightings such as B or D which are not commonly used, are not used in the City of Toronto Noise By-law and are not considered further. No weighting or a flat contour, sometimes referred to as “flat”, “linear” or “Z-weighting” (dBZ) treats all frequencies with equal weight. Many modern sound level meters include flat (Z-weighting), A-weighted and C-weighted networks and may provide simultaneous readings of dB, dBA, and dBC.

If a measurement is made with both dBA and dBC and the numerical values are very similar, this indicates that significant low frequencies are not present. If the dBC values are much higher than the dBA values, this means that there is significant low frequency sound energy present.

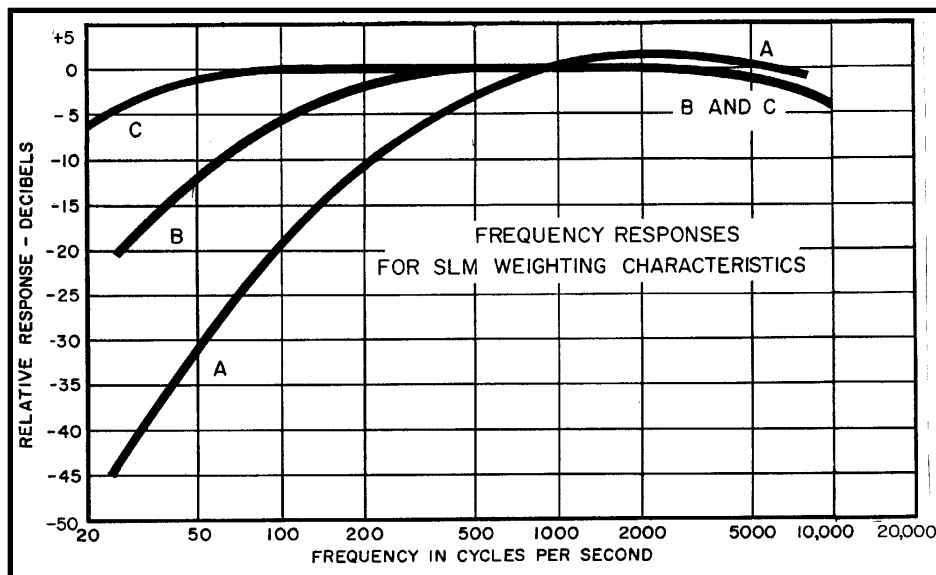


Figure A-3: Frequency Weighting Contours

A2.0 QUANTITATIVE (NUMERICAL) SOUND LEVELS

(Excerpted from Valcoustics report “City of Toronto Municipal Code, Review of Chapter 591, Noise and Proposed Amendments”, October 2, 2018, Project 117-0622.)

This section provides a brief tutorial on sound level metrics/descriptors, to aid in understanding what is meant when a quantitative sound level is specified or discussed.

1) Basic Concepts

A major characteristic of community, environmental noise is that it varies from instant to instant as a function of local and distant activity such as road traffic (cars, buses, trucks, motorcycles, trains, streetcars, airplanes, construction, activities by residents (lawn cutting, etc.), mechanical equipment cycling (e.g., air conditioners), animals (dogs barking), and industrial and commercial operations.

One can make an instantaneous sound level measurement. However, in the case of widely varying sound levels over time, a very brief “snapshot” is not truly representative of the sound environment as a whole or over time. The instantaneous sound level could be taken during a brief peak, brief lull, or anywhere in between and thus, may not be an appropriate representation of the most common sound level over a reasonable time period or the “prevailing ambient”.

As a result, some form of statistical approach is much more meaningful and is usually used. There is a large variety of statistical descriptors that can be used to characterize a varying situation. One commonly used concept is that of a cumulative probability distribution, specifically L_n values where L_n is the sound level exceeded for n % of the time. For example, L_{90} is the sound level exceeded 90% of the time. L_{90} is a reasonable representation of minimum residual (background) sound level because the sound level is only less than L_{90} for 10% of the time. Sometimes L_{99} is used for this. Typically, the lowest sound level in a data set is not more than 1-3 dBA below L_{90} or L_{99} . L_{50} , the sound level exceeded 50% of the time, is the median value. L_{10} is the sound level exceeded for 10% of the time (90% of the time the sound level is less than L_{10}). L_{10} is a good indicator of the upper end of the range. Sometimes L_1 is used for this. The difference $L_{10} - L_{90}$ indicates the range within which the sound levels would vary for 80% of the time.

Various types of averages can be used to characterize a varying situation. However, because of the non-linear, logarithmic relationship between sound energy and sound level and between sound level and human perception of loudness, a simple arithmetic average is not appropriate.

Commonly used is a sound energy average as opposed to a simple, arithmetic average of sound (pressure) levels. Probably the most frequently used descriptor for environmental noise, nationally and internationally, is the energy equivalent continuous sound level, sometimes referred to as the equivalent sound level, abbreviated L_{eqx} , where x is a time period. L_{eq} is the constant sound level that would produce the same total sound energy as the actually varying sound levels, over the defined time period. L_{eq} is a sound energy average and must always be associated with a time period. It must also be associated with a location relative to a source, as is the case with sound (pressure) level.

The shorter the time period, the more stringent the requirement even if the numerical value remains the same. Note, because of the logarithmic relationship between sound energy and sound level (in decibels), L_{eq} is very sensitive to high sound level events, even if the sound event lasts for a short period of time. Thus, it can be viewed as a descriptor that inherently is in the public interest.

2) Ministry of the Environment, Conservation and Parks (MECP) Noise Criteria

The MECP noise guideline sound level limits (criteria) are expressed in terms of the Equivalent Sound Level (L_{eq}) descriptor. Different time periods are used to define the descriptor for different types of sound sources. The MECP uses a 16-hour daytime period and an 8-hour nighttime period for road and rail noise. For industrial/commercial (stationary) sound sources, a one-hour time period is used. The current Chapter 591 incorporates MOECC (now MECP) noise guideline NPC-205 for stationary sources. The sound (noise) criteria in NPC-205 are in terms of the one-hour L_{eq} descriptor (in dBA). NPC-205 has been replaced by NPC-300 as of 2013. NPC-300 continues to use the one-hour L_{eq} for stationary sources and the numerical limits are basically the same.

APPENDIX B

MOTOR VEHICLE SOUND LEVEL LIMIT – MOVING TESTS

TABLE B-1 MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TESTS

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Ground Surface		Distance (m)	Sound Limit (dBA)
				Hard	Soft		
Canada MVR Schedule V.1 (Standard 1106) 2(a)(i)	bus >4536 kg	–	Test Method 1106 full throttle acceleration	–	–	15.2 (50 ft)	83
Canada MVR Schedule V.1 (Standard 1106) 2(a)(ii)	bus, multi-purpose passenger, truck >2722 kg	–	SAE J1470 full throttle acceleration	–	–	–	83
Canada MVR Schedule V.1 (Standard 1106) 2(a)(iii)	passenger car, any weight; other vehicles ≤2722 kg	–	SAE J1470 full throttle acceleration	–	–	–	80
Canada MVR Schedule V.1 (Standard 1106) 2(a)(iv)	bus, multi-purpose passenger vehicles, trucks	–	ISO 362 full throttle acceleration	–	–	–	80
Canada MVR Schedule V.1 (Standard 1106) 2(a)(v)	Passenger car, any weight; other vehicles ≤2722 kg	–	ISO 362 full throttle acceleration	–	–	–	78
Canada MVR Schedule V.1 (Standard 1106) 4(a)	multi-purpose passenger vehicles, trucks	–	40 CFR 205 low speed test	–	–	15.2	80

.../cont'd

TABLE B-1 MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TESTS (continued)

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Ground Surface		Distance (m)	Sound Limit (dBA)
				Hard	Soft		
Canada MVS Schedule V.1 (Standard 1106) 4(b)	multi-purpose passenger vehicles, trucks	–	ISO 362	–	–	15.2	81
Canada MVS Schedule V.1 (Standard 1106) 5(1)(a)	bus, multi-purpose passenger; truck; passenger car	–	UN Reg. No. 51 Annex 3 full throttle acceleration	–	–	15.2	68-77 subject to engine size
Canada MVS Schedule V.1 (Standard 1106) 5(1)(b)	bus, multi-purpose passenger; truck; passenger car	–	UN Reg. No. 51 Annex 7 full throttle acceleration	–	–	15.2	68-77 subject to engine size
Canada MVS Schedule V.1 (Standard 1106) 3(1)(a)	motorcycle	–	UN Reg. No. 41 Annex 3 constant speed and full throttle acceleration	–	–	7.5	73-77 subject to engine size
Canada MVS Schedule V.1 (Standard 1106) 3(1)(b)	motorcycle	–	UN Reg. No. 41 Annex 3 constant speed and full throttle acceleration	–	–	7.5	73-77 subject to engine size
Canada MVS Schedule V.1 (Standard 1106) 3(1)(c)(i)	motorcycle ≤50 cm ³ ; max speed 48 km/hr	–	40 CFR 205 Appendix I-2	–	–	15.2	70
Canada MVS Schedule V.1 (Standard 1106) 3(1)(c)(ii)	motorcycle >50 cm ³	–	40 CFR 205 Appendix I	–	–	15.2	80

.../cont'd

TABLE B-1 MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TESTS (continued)

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Ground Surface		Distance (m)	Sound Limit (dBA)
				Hard	Soft		
40 CFR 202	trucks ≥4536 kg	after 1986	any condition of grade, load, acceleration; ≤35 mph	✓	–	15.2	83
40 CFR 202	trucks ≥4536 kg	after 1986	any condition of grade, load, acceleration; >35 mph	✓	–	15.2	87
40 CFR 205	medium & heavy trucks	after 1988	low speed full throttle acceleration	–	–	15.2	80
49 CFR 325	greater than 4536 kg	–	constant speed ≤35 mph	✓	–	15.2	85
49 CFR 325	greater than 4536 kg	–	constant speed >35 mph	✓	–	15.2	89
49 CFR 325	greater than 4536 kg	–	constant speed ≤35 mph	–	✓	15.2	83
49 CFR 325	greater than 4536 kg	–	constant speed >35 mph	–	✓	15.2	87
UN Reg. 51	passenger* smallest	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	68-72
UN Reg. 51	passenger* medium	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	69-72

.../cont'd

TABLE B-1 MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TEST (continued)

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Ground Surface		Distance (m)	Sound Limit (dBA)
				Hard	Soft		
UN Reg. 51	passenger* largest	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	73-77
UN Reg. 51	trucks smallest	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	69-71
UN Reg. 51	trucks medium	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	74-75
UN Reg. 51	trucks largest	–	wide open throttle acceleration and constant speed at 50 km/hr	–	–	15.2	76-79
Oregon OAR 340-035-0030 Table 3	autos & light trucks	–	any grade, load, acceleration, deceleration ≤45 mph	–	–	15.2	72
Oregon OAR 340-035-0030 Table 3	autos & light trucks	–	any grade, load, acceleration, deceleration >45 mph	–	–	15.2	78
Oregon OAR 340-035-0030 Table 3	autos & light trucks	–	constant speed ≤35 mph	–	–	15.2	70

.../cont'd

TABLE B-1 MOTOR VEHICLE SOUND LEVEL LIMITS – MOVING TEST (continued)

Jurisdiction	Vehicle Type	Vehicle Manufactured	Test Condition	Ground Surface		Distance (m)	Sound Limit (dBA)
				Hard	Soft		
Oregon OAR 340-035-0030 Table 3	motorcycles	–	any grade, load, acceleration, deceleration ≤45 mph	–	–	15.2	78
Oregon OAR 340-035-0030 Table 3	motorcycles	–	any grade, load, acceleration, deceleration >45 mph	–	–	15.2	62 [#]
40 CFR 205	motorcycles greater than 2 Hp greater than 50 cc	after 1986	wide open throttle acceleration	–	–	15	80
UN Reg. 41	motorcycles*	–	constant speed and wide open throttle acceleration	–	–	7.5	73-77

*Subject to power (size) of engine.

[#]Presumably a typo and should have been 82.

APPENDIX C

JURISDICTIONAL REVIEW – CHANGES

APPENDIX C

JURISDICTIONAL REVIEW – CHANGES

1. NEW YORK CITY NOISE CONTROL CODE

The City of New York (NYC) noise control code is part of the NYC Administrative Code, Title 24, Chapter 2.

Subchapter 1: Short Title, Policy and Definitions

No changes since previous review.

Subchapter 2: General Provisions

Section 24-204 to 24-206 – General powers of the commissioner, Investigations and studies by the commissioner, Testing by order of the commissioner

No changes since previous review.

Section 24-207 – Inspection

Amended on January 17, 2018, effective July 16, 2018. Changes are as follows:

- Addition of new subdivisions (e) and (f)
 - (e) requires the commissioner to adopt rules prescribing specific time frames for inspections in response to after hours noise complaints to ensure inspection are most likely to occur at a time that the alleged noise is continued from the time of the complaint or is likely to be repeated.
 - (f) requires the commissioner to publish the manner by which noise levels shall be measured during inspections on the city website.
 - (f) requires the department of environmental protection to submit annual reports on inspections in response to noise complaints that meet specific requirements.

Section 24-217 and 24-217.1 – Exemptions, Measurements

No changes since previous review.

Subchapter 3: Prohibited Noise; General Prohibition

No changes since previous review.

Subchapter 4: Construction Noise Management

Section 24-219 – Noise mitigation rules

Amended on January 17, 2018, effective July 16, 2018. Changes are as follows:

- Wording amended to include any location (sites) where construction is occurring. (a) now reads as follows, changes are underlined:
 - “(a) The commissioner shall adopt rules prescribing noise mitigation strategies, methods, procedures and technology that shall be used [at] where construction [sites] is occurring at any location (sites) whenever any one or more of the construction devices or activities listed below are employed or performed...”
- Steam shovels and steam hoists are removed.
- Interior renovation is added.
- Item (9) is amended to read as follows, changes are underlined, text in square brackets are omitted:
 - (9) [steam or] electric powered hoists.

Section 24-220 – Noise mitigation plan

No changes since previous review.

Section 24-221 – Alternative noise mitigation plan

No changes since previous review.

Section 24-222 – After hours and weekend limits on construction work

No changes since previous review.

Section 24-223 – After hours work authorization

Amended on January 17, 2018, effective April 30, 2018. Changes are as follows:

- Subdivision (d) was amended such that the department will issue an advisory or a violation if aggregate sound levels from the construction site exceed the following limits:
 - (1) 8 dBA, and on or after January 1, 2020, 7 dB(A) above ambient sound levels, as measured inside a residential dwelling unit with windows and doors closed.
 - (2) the noise levels specified in section 24-228 (a) of this code on a construction site that is not within 200 feet of a residential receptor, or
 - (3) except as provided in paragraph (4) of this subdivision, 80 dB(A), and on or after January 1, 2020, 75 dB(A) as measured 50 or more feet from the source or sources at a point outside the property line where the source or sources are located or as measured 50 or more feet from the source or sources on a public right-of-way when that source is within 200 feet of a residential receptor, or

- (4) 85 dB(A) as measured 50 or more feet from the source or sources at a point outside the property line where the source or sources are located, or as measured 50 or more feet from the source or sources on a public-right-of-way when the source is street construction.
- Section 24-223 (e) (4) calls for the commissioner to promulgate rules for construction activities with minimal noise impact and specific mitigation measures for such activities. These rules are found in Title 15 of the Rules of the City of New York, Chapter 30. No changes have been made since the previous review.

Section 24-223.1 – Stop work order

No changes since previous review.

Subchapter 5: Prohibited Noise Specific Noise Sources - Sound Level Standard

This subchapter sets sound level limits for specific sources (Section 24-225 to 24-232). For some sources, the code not only sets a sound limit during operation but also prohibits the sale or offering for sale of non-complying equipment. Table 6-1 from the 2018 Valcoustics report has been updated and summarizes the sound limits for various equipment and activities.

No changes have been made to Sections 24-225, 24-226, and 24-228 to 24-230 since the last review.

TABLE 6-1 UPDATED: NYC SOUND LEVEL LIMITS
(original Table 6-1 from Valcoustics October 2, 2018 report)

Code Section	Source	Sound Level Limit	Comment
24-223 New	After hours construction	Non-impulsive: 75 dBA at 50 ft or more from source; at a point outside source property if within 200 ft of a residential receptor; Maximum 7 dBA above ambient inside residential unit with windows and doors closed.	Not explicit but implicit that the new sound limits apply to non-impulse sounds. Impulse sound limit unchanged.
24-225	Refuse collection vehicles	80 dBA @ 35 ft 80 dBA within 50 ft of residential property, 11:00 pm to 7:00 am	Slow response; during compacting cycle with no compacting load. Does not apply in emergency such as snowstorm causing delays in refuse collection.
24-226	Air compressors	80 dBA at 1 m, greater than 350 cfm; 75 dBA at 1 m, 350 cfm or less	Must have muffler & no exhaust leaks
24-227	Circulation devices	42 dBA inside a receiving property dwelling unit for new device, cumulative total of all devices to not exceed 45 dBA	Circulation Device = any device circulating gas or fluid = fan, blower, pump, cooling tower, air conditioner, etc. Measured inside, 3 ft from open window or terrace door. Commissioner may recommend no civil penalty, subject to conditions.
24-228	Construction, exhausts and other devices	Non-impulsive: 85 dBA at 50 ft or more from source; at a point outside source property; Impulse: 15 dBA above ambient; at any point on a receiving property or at 15 ft or more from source on public right-of-way	Ambient measured on slow response; impulse on fast response must comply with aggregate limit even if individuals comply.
24-228.1	Exhausts	No unreasonable noise; includes but not limited to sound exceeding limits of 24-228	
24-229	Containers and construction material	Non-impulse: 10 dBA above ambient at any point on receiving property or at 15 ft or more on public right-of-way. Impulsive: 15 dBA above ambient at any point on receiving property or at 15 ft or more on public right-of-way	Applies to handling or transporting construction material. Ambient measured on slow response; impulse on fast response.
24-230	Paving breakers	95 dBA at 1 m	Requires muffler with 5 dBA insertion loss for air discharge.
24-231	Commercial music	42 dBA, or 45 dB in any 1/3 octave band, 63 to 500 Hz, or 6 dBC above ambient, providing ambient exceeds 62 dBC, inside a dwelling unit.	Music from or in commercial establishment or enterprise measured inside any receiving property dwelling unit. Commissioner may recommend no civil penalty providing conditions satisfied.

Section 24-227 – Circulation devices

Amended on July 18, 2021, effective November 15, 2021. Changes are as follows:

- Wording added to subdivision (d) to allow for the respondent to apply for additional time to submit a certification of compliance. The time that the respondent must file a certification was amended to within 30 days after issuance of the notice of violation or any additional time granted by the commissioner.

Section 24-231 – Commercial music

Amended on July 18, 2021, effective November 15, 2021. Changes are as follows:

- Changes to subdivision (b)(1) to allow for the respondent to apply for additional time to submit a certification of compliance (this was previously included in (b)(2)). The time that the respondent must file a certification was amended to within 30 days after issuance of the notice of violation or any additional time granted by the commissioner.
- Subdivision (b)(2) was removed.

Section 24-232 – Allowable decibel levels – octave band measurement.

Amended on July 18, 2021, effective November 15, 2021. Changes are as follows:

- Subdivision (g) was added to allow opportunities for the respondent to cure the first violation of this section or any rules promulgated pursuant to this section if a certification is filed within 30 days after the issuance of the notice of violation and certain condition are met.

Section 24-232.1 – Wind turbines.

This section was added on May 26, 2018 in L.L. 2018/105, effective November 22, 2018. It was then Amended on May 19, 2019, effective November 15, 2019.

This section limits the sound level due to the operation of a small or large wind turbine (defined) to 5 dB(A) above the ambient sound level, measured at the property line or at an elevated receptor of the property containing the nearest occupied building.

Subchapter 6: Specific Noise Sources Plainly Audible and Other Standards

No changes have been made to Subchapter 6 since the previous review. This Subchapter includes Sections 24-233 to 24-244.

Subchapter 7: Certificates and Tunnelling Permits

No changes have been made to Subchapter 7 since the previous review.

Subchapter 8: Enforcement

Section 24-257 – Powers of the board

Amended on July 18, 2021, effective November 15, 2021. Changes are as follows:

- A number of the civil penalties listed in Table I were removed, added and changed.

- Wording was added to subdivision (g) that limits the default penalties to 400 percent of the penalty amount for violation of this chapter, except for violation of subdivision (a) of section 24-218, which may not exceed 150 percent.
- Addition of subdivision (h) which lists the sections for which the first violation has a cure period (Sections 24-218, 24-227, 24-231 and 24-232) and details the civil penalty for violation of subdivision (d) of section 24-218.1 or any rules promulgated pursuant to that section.

2. RULES - TITLE 15 CHAPTER 28 – CITYWIDE CONSTRUCTION NOISE MITIGATION

Section 28.100 – General Construction Noise Mitigation Plan

Amended City Record September 18, 2018, effective October 18, 2028. Changes are as follows:

- Reference to Section 24-220 was added.
- Text was added stating that the Construction Noise Mitigation Plan is to be filed with the Department of Environmental Protection (DEP), except for emergency work completed within 3 days or less. This was not required previously.
- Text was added stating that an after hours variance may be applied for if work is not possible during otherwise allowable hours.
- Text stating that the Construction Noise Mitigation Plan Form is available at DEP's Offices has been removed.

Section 28-101 – Required Noise Mitigation Measures for General Construction.

Amended City Record September 18, 2018, effective October 18, 2028. Changes are as follows:

- Section 28-101 (n), added text stating that for emergency work lasting no longer than 3 consecutive days, filing the Construction Noise Mitigation Plan with the DEP is not required.
- Construction work completed within a continuous period of 24 hours, including work that occurs outside of the hours of 7:00 am and 6:00 pm on weekdays, need not file the Noise Mitigation Plan with the DEP. Previously, it was required that the work occur between these hours, this text has been removed.

Section 28-102 – Construction Devices and Activities.

Amended City Record September 18, 2018, effective October 18, 2028. Changes are as follows:

- In the opening paragraph of Subparagraph C of Paragraph 2 of Subdivision a, reference to 15 RCNY Section 28-106(p) is removed (15 RCNY Section 28-106(p) was repealed).

Section 28-103 – Authorized Work Hours

No changes since the previous review.

Section 28-104 – Alternative Noise Mitigation Plan.

No changes since the previous review.

Section 28-105 – Utility Noise Mitigation Plan.

Amended City Record September 18, 2018, effective October 18, 2028. Changes are as follows:

- Wording amended such that an exception was added for emergency work performed in three days or less and reference to Section 24-220 was added; changes are underlined:
 - “Pursuant to § 24-219 and § 24-220 of the Administrative Code, every authorized publicly franchised New York City utility company that provides gas, electric, steam and telecommunication services, except when emergency work will be performed in three days or less, shall have conspicuously posted, a complete and accurate Utility Noise Mitigation Plan at all sites where construction activities take place. A generic plan per borough may be used to satisfy the filing and posting requirement, provided such plan is posted and filed with the department and otherwise complies with the requirements for a Utility Noise Mitigation Plan. Although the plan need not be filed with DEP, it shall be readily available for inspection should a complaint be filed or during a routine inspection. The Utility Noise Mitigation Plan Form is available at: [<http://www.nyc.gov/dep> or at DEP’s Offices at:
 - New York City Department of Environmental Protection
 - Bureau of Environmental Compliance, 9th Floor
 - 59-17 Junction Blvd.
 - Flushing, NY 11373] <http://www.nyc.gov/html/dep/html/noise/construction-noise-shtml>.”

Section 28-106 – Required Noise Mitigation Measures for Utilities.

No changes since the previous review.

Section 28-107 – Perimeter Noise Barriers.

No changes since the previous review.

Section 28-108 – Temporary or Portable Noise Barriers.

No changes since the previous review.

Section 28-109 – Definitions.

No changes since the previous review.

Section 28-110 – Interior Renovation Work Noise Measures.

Section 28-110 was added in the Amended City Record on September 18, 2018, effective October 18, 2028.

This section provides mitigation techniques to control for interior renovation noise. The responsible party is required to select tools on the DEP approved list (or rated to the same sound reduction or certified to a lower decibel than the tool cited in each applicable section) and a list of acceptable examples for various tools are provided.

3. CITY OF CHICAGO – CHAPTER 8-32 NOISE AND VIBRATION CONTROL (CHICAGO NOISE ORDINANCE)

Section 8-32-010 – Short title

No changes since the last review.

Section 8-32-020 – Definitions

Since the previous review, the definitions for the following terms have been amended:

The definition for “Noise Disturbance” has been changed to “*any sound which is audible at a distance of 600 feet or more from the source*”. The wording “*or sound exceeding 70 dBA “on the public way” when measured at 10 ft or more from the source*” was removed.

Section 8-32-030 to 8-32-050 – Rules and Regulations; Most restrictive limits to apply; Remedies and Violations

No changes since the last review.

Section 8-32-060 – Designation of noise sensitive zones

Amended on November 20, 2019. Changes are:

- The process for designation of noise sensitive zones was amended such that an ordinance amending Section 8-32-065 (added on November 20, 2019) must now be passed, having found in consultation with the Department of Police and Department of Public Health that such zone is an area where noise sensitive activities take place. Before this amendment, the superintendent of police was authorized to prepare recommendations to be approved by the city council.
- The Commissioner of Transportation must install conspicuous signage identifying noise sensitive zones.

Section 8-32-065 – Designated noise sensitive zones

This section was added on November 20, 2019. It lists the designated noise sensitive zones pursuant to Section 8-32-060.

Section 8-32-070 – Music and Amplified Sound

No changes since previous review.

Section 8-32-080 – Regulated Entertainment Businesses

Amended on May 20, 2020 and May 23, 2022. Changes are:

- An exception was added to subsection (a) for an Outdoor Entertainment Venue which shall not be bound by this restriction from 10:00 a.m. to 10:00 p.m.
- Addition of Subsection (d) which limits the fine for any person found in violation of this section.

Section 8-32-090 – Mechanical Stationary Sources

Amended on October 27, 2021. Changes are as follows:

- Addition of Subsection (f) which limits the fine for any person found in violation of this section.

Section 8-32-100 – Emergency Signal Devices

No changed since previous review.

Section 8-32-110 – Non-emergency Signal Devices

No changed since previous review.

Section 8-32-120 – Restrictions Within Noise Sensitive Zones

Amended on November 20, 2019. Changes are as follows:

- The prohibited methods of creating or causing sounds that interfere with the functions of any school, library, church, hospital, or nursing home, or other noise sensitive activity are now specified. They include the use of a bullhorn or loud and raucous electronic amplification, or by use of an object that is struck manually or with a stick or similar item to produce a sharp percussive noise.

Section 8-32-130 – Loading and Unloading Operations

No changed since previous review.

Section 8-32-140 to 8-32-170 – Construction, Repair or Demolition Equipment, Limitations on Noise Not Otherwise Addressed, Limitations on Earthshaking Vibrations, Exceptions and Exclusions

No changed since previous review.

4. PORTLAND OREGON – TITLE 18 NOISE CONTROL

Chapter 18.02 – Title

No changes since previous review. This Chapter includes Sections 18.02.010 (Title) and 18.02.020 (Policy Statement).

Section 18.04.010 to 18.04.020 – Terminology and Standards, Measurement of Sound

No changes since previous review.

Section 18.04.040 – Definitions

Last amended on March 1, 2020. Changes are as follows:

- The “commercial” category has been replaced by a “commercial/mixed” use category in the table in subsection FF. Additionally, the land use zones listed in the table have been changed for the Residential and Commercial/Mixed Use categories.

Chapters 18.06 to 18.08 – Responsibilities and Authority, City Bureaus

No changes since last review. These chapters include Sections 18.060.010 Noise Control Officer, 18.060.020 Noise Review Board, 18.060.030 Responsibilities, 18.060.040 Authority, 18.080.010 Bureau Actions, 18.080.020 Compliance with Other Laws, and 18.080.030 Product Selection.

Section 18-10-010 – Land Use Zones (Sound Level Limits)

Last amended on May 24, 2018. The changes are as follows:

- All references to the “commercial” source and receiver zones have been replaced by “commercial/mixed use” source and receiver zones. Figure 1 in this section has been amended to reflect this change, the sound level limits provided remain unchanged. See Table 6-3.

TABLE 6-3
FIGURE 1
PERMISSIBLE SOUND LEVELS
(7 am-10 pm, otherwise minus 5dBA)

		Zone Categories of Receiver (measured at property line)			
		Residential	Open Space	Commercial/Mixed Use	Industrial
Zone Categories of Source	Residential	55	55	60	65
	Open space	55	55	60	65
	Commercial/Mixed Use	60	60	70	70
	Industrial	65	65	70	75

Adjustments to Figure 1

1. During the night hours, the sound levels of Figure 1 shall be reduced 5 dBA.
2. During all hours, the sound levels of Figure 1 shall be decreased 5 dBA for narrow band or steady sound (apply 1 only).
3. The adjustments provided herein are cumulative.

Section 18.10.020 to 18.10.030 – Motor Vehicles, Home Equipment and Powered Tools

No changes since the previous review.

Section 18.10.035 – Leaf Blowers

Amended May 24, 2018. Changes are as follows:

- All references to the “commercial” source and receiver zones have been replaced by “commercial/mixed use” source and receiver zones.

Section 18.10.040 to 18.10.070 – Watercraft, Motor Vehicle Racing Events, Construction Activities and Equipment, Parking Lot Sweepers

No changes since the previous review.

Section 18.12.010 – Noise Disturbance Prohibited

No changes since the previous review.

Section 18.12.020 – Specific Prohibitions

No changes since the previous review.

Section 18.12.030 – Provisions if Measurement is Made

No changes since the previous review.

Section 18.14.010 – Exemptions

No changes since the previous review.

Section 18.14.020 – Variances

No changes since the previous review.

Chapter 18.17 – Rulemaking

No changes since the previous review.

Section 18.18.010 and Section 18.18.020 – Authority for Enforcement, Violations

No changes since the previous review.

Section 18.18.030 – Civil Penalties and Fees

Amended March 6, 2019. Changes are as follows:

- This section was updated to reflect the transfer of duties from the Auditor Assessment, Finance, and Foreclosure Division (the Auditor’s Office) to the Bureau of Revenue of Financial Services’ Revenue Division (the Revenue Division).

Section 18.18.040 and 18.18.060 – Citations, Review by the Director, Institution of Legal Proceedings

No changes since the previous review.

Section 18.20.010 – Severability Provision

No changes since the previous review.