



NOISE FROM OUTDOOR MUSIC ACTIVITIES: SELECTED EXAMPLES OF REGULATIONS AND RECOMMENDATIONS

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According to the World Health Organization, environmental noise features among the top environmental risks to physical and mental health and well-being. Environmental noise includes noise produced by transport traffic, industrial activities, neighborhood and leisure activities. Among the leisure activities which may cause hearing impairment and environmental noise annoyance include fireworks, shooting ranges, car racing and outdoor music activities; this study focuses on the latter. Examples of regulations from Australia, Belgium, France, United Kingdom and Canada (Québec city and Montréal) are presented. It is shown that regulations are not harmonized, many different indicators, limit values, measurement locations, and measurement times are used to protect attendees or residents living in noise sensitive areas.

Keywords: leisure activities, environmental noise

1. Introduction

Environmental noise is defined by World Health Organization (WHO) as the noise from all sources except occupational noise. It is an important public health issue, featuring among the top environmental risks to health [1]. Environmental noise includes noise produced by transport traffic, industrial activities, neighborhood and leisure activities.

In 2016, through a governmental health prevention policy, the Quebec government decided to take actions to reduce the harmful effects of environmental noise on the health and quality of life of the population [2]. However, the population's exposure to noise is very poorly documented in Quebec, particularly that related to outdoor leisure activities. According to a recent interdepartmental action plan, one of the priority actions is to give recommendations, in the short term, to municipalities, promoters, and organizers of major events for the prevention and management of noise issues associated with a number of outdoor recreational activities generating environmental noise: outdoor music activities, fireworks, shooting ranges, and car racing. The population of interest (i.e., to be protected from harmful effects of leisure activities' noise) are (i) the attendees potentially exposed to high noise levels that could lead to hearing disorders and (ii) the residents living close to the venues (referred to as "noise-sensitive areas")

in this paper) who are exposed to “low” noise level that nevertheless can impact their health and quality of life. The purpose of a research project recently founded by a Quebec ministry is to define some recommendations for Quebec municipalities to help them with planning and managing noisy outdoor leisure activities. To reach this goal, a systematic review based on Quebec and worldwide documents (academic and grey literature) is performed in order to identify and evaluate (i) guide values and limit values together with their efficiency and limits and (ii) best practices in terms of planning, management and practical solutions for noise abatement of recreational activities. This presentation presents preliminary results of this systematic review and focuses on selected examples of recent recommendations and regulations dedicated to outdoor music activities and coming from various countries, states or large cities; Australia, Belgium, France, United Kingdom (UK) and Canada (for the city of Quebec and Montreal).

2. Indicators

The acoustic indicators presented in the selected documents are described as follows:

- $L_{Xeq,T}$ represents the X -weighted continuous equivalent noise pressure level during a specific time period T where X represents the frequency weighting (A, C and Z (for no weighting))
- $L_{AYmax(T)}$ represents the A-weighted maximum noise pressure level measured over T minute(s) period where Y represents the time weighting (Impulse $I = 35$ ms; Fast $F = 125$ ms; Slow $S = 1$ s)
- L_{Cpeak} represents the C-weighted maximum value reached by noise pressure with no time constant applied
- $L_{AX\%,T}$ represents the A-weighted noise pressure level exceeded for $X\%$ of the measurement time and calculated by statistical analysis.

3. Examples in different countries and cities

This section briefly describes some contemporary regulations and recommendations in different countries, states or large cities. In all subsections, the regulations/recommendations dedicated to the residents living in noise-sensitive areas are first presented followed by those dedicated to attendees. The following aspects are covered for the regulations/recommendations dedicated to the residents living in noise-sensitive areas: description of the context, periods of noise limits, measurement locations and limit values.

3.1 Australia

In most cases, Australian environmental noise regulations with regard to outdoor music activities are defined by the Environment Protection Act for each state and deferred to local authorities to take into account specific local issues.

In the case of regulations dedicated to noise-sensitive areas, Table 1 provides the Australian major event policies based on the work of Parnell and Hartcher [4]. The event times, noise objectives and associated indicators at receivers are presented for four states and two cities. As shown in Table 1, events can occur until 22.00 and 23.00 in the evening. In Adelaide and Brisbane, measurements at the “front of house” (FoH) position (which is usually at the mixing desk) are conducted. For instance, the limit value of $L_{Ceq,15min}$ at FoH is 110 dB(C) in Adelaide. In Brisbane, at the FoH, the values of the global level $L_{A10,5min}$ has to be lower than 100 dB(A) and $L_{A10,5min}$ measured specifically on the octave band 63 Hz has to be lower than 105 dB(A). However, these specific measurement locations are mainly intended to protect residents living close to the venue. Similarly, the state of Western Australia requires specific measurements at noise-sensitive areas. For example, in addition to dwellings, the regulation also applies to health and educational institutions [5] [6]. Moreover, maps indicating strategic measurement points (hotels, cathedrals, terraces, specific streets) are given for specific venues in Adelaide [7]. For the state of Victoria [8], outdoor measurement points should be chosen in order to measure the maximum noise level in the noise-sensitive area. In other Australian regulations, the distance between the sound level meter

and the façade is given. For instance, for the state of Western Australia, measurements must be carried out at 3 m of any reflective surfaces at a height of 1.2 m to the ground [6].

From Table 1, it can be noticed that there is a large dispersion between noise limit values measured at noise-sensitive areas. Noise limit values are between 55 dB(A) and 75 dB(A). In addition to the noise limit values, there is no harmonisation between states and cities with regard to event times, measurement points and indicators. This may be explained by the fact that states, and more specifically the cities, adapt regulations to their own geographical context.

Noise objectives have been mainly designed to minimize the impact on noise-sensitive areas surrounding the venue rather than to reduce the risks of attendees’ hearing damage. Guidelines for protecting the hearing of attendees at music venues are currently being developed [3].

Table 1: Australian Major Event Policies [4]

States and Cities	Guiding Policy	Event times	Indicators	Noise Objectives at Receivers (unless otherwise stated)	
Queensland	Environmental Protection Act	07.00 – 22.00	$L_{A10,T}$	70 dB(A)	
		22.00 – 00.00	(50 dB(A) or $L_{A90,T}$) + 10 dB(A)		
Brisbane city (Queensland)	BCC Local Law Policy (Entertainment Venues and Events)	On a case-by-case basis	$L_{Aeq,15min}$	55 dB(A)	
			$L_{A10,T}$	70 dB(A)	
			$L_{Aeq,15min}$	FoH	95 dB(A)
					100 dB(A)
$L_{A10,5min}$	105 dB(A) @ 63Hz				
New South Wales	Noise Guide for Local Government	Depending on location and guiding policy			
Victoria	State Environment Protection Policy (Control of Music Noise from Public Permisses) No. N-2	Til 23.00	$L_{Aeq,30min}$	65 dB(A)	
		22.00 if > 5 hours Other hours			Council criteria applies
Western Australia	Environmental Protection (Noise) Regulations.	07.00 – 19.00	$L_{ASmax,T}$	65 dB(A)	
		19.00 – 07.00		60 dB(A)	
Adelaide city (South Australia)	Adelaide City Council. Event Noise Mitigation SoP.	07.00 – 23.00	$L_{Aeq,5min}$	60 dB(A)	
			$L_{AXmax,1min}$	75 dB(A)	
			$L_{Zeq,T}$	70 dB(Z) in 31.5 / 63 / 125 Hz	
			$L_{Ceq,15min}$	FoH	110 dB(C) (recommended)

3.2 Belgium

In Belgium, federal regulation determines the regulatory framework for music activities. However, Belgian regions apply their own regulations. In the Flemish region, the noise regulation for music activities (which take place in a tent, in the open-air, or in public establishments) can be found in VLAREM-II (in chapters 5 and 6) since 2014 [9]. Moreover, based on the Flemish regulatory framework, the Brussel-Capital region has also established its own regulation since 2018. The Walloon region still uses the federal regulation [10]. However, since 2019, a new legal text, based on the Flemish and Brussel-Capital region, has been published but it is not yet in force. This section thus focuses on the Flemish regulation.

In the case of regulations dedicated to noise-sensitive areas, there are no event times for outdoor activities unlike the Australian policies. However, the noise limit values are based on the background noise which tends to decrease during the nighttime (therefore, the noise limit values become more stringent).

The noise limit values are given for noise levels measured inside buildings near the event (closed doors and windows).

Table 2 presents the background noise values and noise limit values at sensitive areas surrounding the music activity. For instance, if the background noise is below 30 dB(A), the $L_{ASmax,T}$ cannot exceed the background noise value by more than 5 dB(A). For a background noise higher than 35 dB(A) the $L_{ASmax,T}$ has to be lower than the background noise value.

Table 2: Noise limits values based on background noise values at sensitive areas inside building [6]

Background noise	Noise limits
$L_{A95,5min} < 30 \text{ dB(A)}$	$L_{ASmax,T} \leq L_{A95,5min} + 5 \text{ dB(A)}$
$30 \text{ dB(A)} \leq L_{A95,5min} \leq 35 \text{ dB(A)}$	$L_{ASmax,T} \leq 35 \text{ dB(A)}$
$L_{A95,5min} > 35 \text{ dB(A)}$	$L_{ASmax,T} \leq L_{A95,5min}$

In the case of regulations dedicated to attendees, Table 3 presents several requirements with regards to noise management, and sound level limits apply to all possible places in the establishment where there may be attendees. For example, the sound level must be displayed and monitored by the operator of the premises, or his/her designate, or limited by a noise limiter if the noise emission based on $L_{Aeq,15min}$ is greater than 95 dB(A). In this case, sound levels must be recorded by the operator and may be submitted to the authorities [9]. In addition, hearing protectors must be provided to the attendees free of charge.

Table 3: Noise management requirements depending on noise emission [9]

Noise emissions		Requirements	
$L_{Aeq,15min} > 85 \text{ dB(A)}$	$L_{ASmax,T} \leq 102 \text{ dB(A)}$	Sound level displayed and monitored by the operator	
$L_{Aeq,15min} \leq 95 \text{ dB(A)}$		Sound level displayed and monitored or limited by a noise limiter	Provision of free hearing protection
$L_{Aeq,15min} > 95 \text{ dB(A)}$	$L_{ASmax,T} \leq 102 \text{ dB(A)}$	Sound level displayed and monitored or limited by a noise limiter	
$L_{Aeq,1h} \leq 100 \text{ dB(A)}$		Provision of free hearing protection	

Promoters must submit an application in order to obtain local authorities’ approval wherever music activities take place. Moreover, local authorities can prescribe additional conditions with regards to duration and sound level limits for the attendees, but it is strictly prohibited to exceed $L_{Aeq,1h} = 100 \text{ dB(A)}$. Nevertheless, the requirement is considered to have been met if $L_{ASmax(T)} = 102 \text{ dB(A)}$ [9].

3.3 France

In France, a national decree is in place for music outdoor activities. However, administrative authorities like departmental prefectures, municipalities, and the police prefecture of Paris may require stricter noise regulations. For instance, the departmental prefect of Savoie imposed in 2015 a sound limit value of $L_{Aeq,15min} = 103 \text{ dB(A)}$ at the FoH for Musiclac Festival. At that time, there weren’t any sound level regulations for outdoor music activities. In the new 2017 national decree [11], the sound limit values are given for indoor and outdoor amplified music. However, the noise limits conceived to protect noise sensitive areas of music activities are only applicable to indoor music activities. Reference should be made to a previous 2006 decree [12] to obtain specific information about noise-sensitive areas for outdoor activities. However, the 2006 decree is more general and applies at once to sport, professional, and leisure activities.

In order to minimize the noise impact at noise-sensitive areas, noise limits are given according to specific periods, daytime is defined between 07.00 – 22.00 and nighttime between 22.00 – 07.00.

Measurements must be made inside dwellings only, with the windows open or closed.

Noise-limit values for noise sensitive areas in the vicinity of music venues (see Table 4) are based on background noise measured according to French standard NF S 31-010. For example, for the 125 Hz and the 500 Hz octave bands, the noise emission must not exceed 7 dB(Z) with regards to the background

noise level. Moreover, criteria on global emergence must not exceed 5 dB(A) in the daytime and 3 dB(A) at nighttime. In addition, correction terms must be applied according to cumulative duration of the noise.

Table 4: Noise limits based on background noise [12]

Spectral emergence for normalized and centered octave bands	Global emergence	
	Daytime	Nighttime
7 dB @ 125 and 500 Hz	5 dB(A)	3 dB(A)
5 dB @ 500, 1000, 2000 and 4000 Hz		

In the case of regulations dedicated to attendees, restrictions must be applied depending on the number of attendees if $L_{Aeq,8h}$ exceed 80 dB(A). As shown in Table 5, the sound level must not exceed 102 dB(A) and 118 dB(C) based on $L_{Aeq,15min}$ and $L_{Ceq,15min}$ indicators, respectively. In addition, noise limits are more restrictive for the events organized for young attendees. The sound limits apply to all possible places in the establishment where there may be attendees. For less than 300 participants, quiet zones intended for “auditory rest” must be available where sound level does not exceed 80 dB(A). To protect attendees’ hearing, free hearing protection devices must be available. Moreover, attendees must be informed about hearing damage related to high sound level. For 300 or more attendees, the sound level must be displayed to warn attendees of their sound exposure. L_{Aeq} and L_{Ceq} must be recorded continuously in order to ensure that noise levels have not exceeded sound limits.

Table 5: Noise limits values depending on attendees’ age [11]

Events organized for attendees who are:	Noise limits
< 7 years old	$L_{Aeq,15min} \leq 94$ dB(A) $L_{Ceq,15min} \leq 104$ dB(C)
≥ 7 years old	$L_{Aeq,15min} \leq 102$ dB(A) $L_{Ceq,15min} \leq 118$ dB(C)

3.4 United Kingdom

The United Kingdom Noise Council has proposed a Code of Practice on Environmental Noise Control at Concerts that can be applied to outdoor music events in order to protect noise-sensitive areas [13]. Some cities of the UK have used this guideline in order to develop their own regulation.

In order to minimize the noise impact at noise-sensitive areas, noise limits are given according to specific periods, daytime is defined between 09.00 – 23.00 and nighttime between 23.00 – 09.00. During nighttime, music should not be audible at the nearest sensitive areas.

Noise impacts are measured during daytime at the facade of any noise-sensitive areas surrounding the venue.

Noise limits depend on two factors, calendar year and venue category, as shown in Table 6. For example, noise emissions at urban stadiums or arenas must not exceed $L_{Aeq,15min} = 75$ dB(A) for a maximum of three concert days per calendar year and per venue.

Table 6: Noise limits at noise-sensitive areas [13]

Concert days per calendar year, per venue	Venue Category	Guideline
1 to 3	Urban Stadiums or Arenas	$L_{Aeq,15min} \leq 75$ dB(A)
1 to 3	Other Urban and Rural Venues	$L_{Aeq,15min} \leq 65$ dB(A)
4 to 12	All Venues	$L_{Aeq,15min} \leq L_{A90,T} + 15$ dB(A)

In addition to the general recommendation, noise objectives can be found for specific and permanent areas in several cities and locations in the UK [14]. Moreover, Manchester city council may set additional criterion in terms of low-frequency depending on the type of music being performed. For instance, low-frequency noise limit values have to be lower than 75 dB(Z) for 63Hz and 125Hz octave bands at noise-sensitive areas [15].

Unlike occupational activities, there are no specific regulations setting sound limits for protecting the hearing of attendees. However, the Health and Safety Executive makes some recommendations. Recommended noise target values must not exceed $L_{Aeq,T} = 107$ dB (A) and $L_{Cpeak} = 140$ dB(C) over the duration of the event; monitoring must be made close to the FoH. Moreover, when the sound level is likely to exceed $L_{Aeq,T} = 96$ dB(A), it is recommended to advise attendees about hearing risks [15].

3.5 Canada

There are no Canadian federal or Quebec provincial regulations for noisy large events. Hence, noise limits are mostly regulated by municipal bylaws. This preliminary study focuses on the two most populated cities in Quebec: Quebec City and Montreal.

3.5.1 Quebec City

Noise level generated by device or equipment for amplifying sounds outside is prohibited if they exceed maximal noise levels prescribed.

Noise limits depends on the period of the day and on the location (as shown in Table 7).

Penalties must be added for sounds containing impulsive noise, information bearing sound (speech or music) and audible pure tones. Adjustments must also be applied depending on background noise in order to compare values with normalized noise presented in Table 7.

Outdoor events cannot occur between midnight until noon the next day and this regulation doesn't apply to events authorised by the council of the city.

Table 7 : Maximal normalized noise level

Inhabited place	12.00 – 19.00	19.00 – 23.00	23.00 – 00.00
Bedroom	45 dB(A)	40 dB(A)	38 dB(A)
Living room	45 dB(A)	40 dB(A)	40 dB(A)
Other room	45 dB(A)	45 dB(A)	45 dB(A)
Non-built space	60 dB(A)	55 dB(A)	50 dB(A)

3.5.2 Montreal

For the city of Montreal, noise production outdoors is normally prohibited [17]. According to its noise by-laws (B-3, article 9), noise that is produced by sound systems, (whether they are located inside a building or installed or used outdoors) is prohibited when it can be heard from outside

However, authorisations may be distributed by city officials and additional requirements must be respected by the promoters. The only requirement in terms of noise level limit is that the noise level measured at 35 m from the source cannot exceed 80 dB(A). Although the measurement integration time of the L_{Aeq} is not specified, noise control officers recommend 15 minutes long measurements. However, for small parks or urban squares where dwellings are located less than 35m from the source, this single rule is not applicable and would require additions and/or amendments.

Specifically for Montreal main entertainment district, Quartier des Spectacles, and according to the official document describing its rules and policies for outdoor events [18], sound systems may require approval by a representative of the city to evaluate and, if needed, minimize, the impact at noise-sensitive areas. However, this requirement has no legal power. Amplified sound emission can occur only until 23.00 or 00.00 depending on the type of event. Sound checks are prohibited between 07.00 – 10.00, 12.00 – 13.30 and 17.00 – 19.00.

On the other hand, the noise management plan of Ville-Marie borough (which comprises all of downtown Montreal, including the Quartier des spectacles and the Old Port) seeks to place greater responsibility on promoters. The event organizer should communicate with a city noise control officer to plan a noise impact assessment across noise-sensitive areas. In order to monitor noise levels and risks of complaints, it is required to use either a (continuous) monitoring system or to carry measurements several times during the event at several locations. A coordinator should be available in order to receive noise complaints. Promoters should notify the residents from the surrounding area about event details. In terms of protecting attendees' hearing, the ordinance associated with the city noise by-laws (ordinance 2) specifies a noise limit of 98 dB(A) when measured at 3 meters from the loudspeakers [19].

4. Discussion and conclusion

From the selected noise regulations/recommendations previously described, it is observed that they largely differ from the used indicators, limit values, measurement locations, and measurement times.

In the case of regulations/recommendations dedicated to noise-sensitive areas, measurements can be carried out either inside or outside the dwellings and even at the FoH, directly or by emergence, and by a range of indicators (e.g. L_{A10} or L_{Aeq}) for different measurement periods.

Consequently, it is difficult to compare all the regulations/recommendations. This could be explained by the fact that each country, state, province, region or city sets regulations adapted to their own legal, cultural or geographical context. In this regard, it worth noting that measurement locations are more precise when cities develop their own regulations. Indeed, they may indicate strategic measurement points for specific venues across the city, intended for noise monitoring (city of Adelaide [7]).

However, regulations/recommendations also share some commonalities. All those regulations / recommendations use directly the measured L_{Aeq} values except Quebec City whose regulation is based on a normalised noise limit. For example, $L_{Aeq,15min}$ is found in each regulation/recommendation (except Quebec City) and used for both attendees-areas and sensitive-areas.

For most of these countries, some noise limits, dedicated to noise-sensitive areas, are based on emergence values except Quebec City and Montreal. Nevertheless, regulations have at least one indicator based on noise background except the city of Montreal. Moreover, Australia and Belgium are the only ones using three indicators: energetic, crest and statistic.

Each regulation/recommendation provides event times except Belgian (Flemish region) regulations which define noise limit values based on background noise. Hence, noise limit values will tend to be more stringent at nighttime. .

All selected regulations/recommendations use A-weighting noise limits values for both the attendees and noise-sensitive areas.

Based on these preliminary results, it is shown that noise regulations could benefit from using multiple types of indicators such as energetic, crest and emergence. These types of indicator are complementary because they provide respectively, a time-weighted average level, a maximal value (with or without time weighting) and the difference between background noise and the source level. Moreover, the spectral (high, medium and low frequencies) or temporal (rhythmic, impulsive, intermittent and fluctuating) characteristics of the noise shall also be considered.

It is worth noting that the A, B and C-weightings are respectively based on the 40 dB, 70 dB and 100 dB equal loudness curves. For a global sound level less than 55 dB, A-weighting is generally required, above 85 dB, C-weighting is more representative, and between these two values, B-weighting is recommended (but this weighting is almost never used). This point could be taken into account in the regulations / recommendations (as proposed in the new French regulation for amplified music areas [11]; the

limit values are given in A and C-weighting). Furthermore, the effectiveness of the A, B and C-weightings to characterize the low-frequency impact at noise-sensitive areas are limited (especially dB(A)) [21]. Hence, noise regulations proposing to monitor and control leisure noise by means of Z-weighting (no weighting) low-frequency octave bands are emerging (for example see Adelaide [7], Brisbane [5], and Manchester [15]). However, low-frequency octave band measurements are not “user friendly to apply in practice” [20]. In addition, the use of psychoacoustic indicators, such as the loudness (ISO 345 [22]), should be considered since they could be more appropriate than the weighted noise pressure level [23].

Based on a portion of the systematic literature review, selected examples of recent recommendations and regulations dedicated to outdoor music activities have been presented in this paper. This work should however be completed in order to provide recommendations for Quebec municipalities to help them with planning and managing noisy outdoor leisure activities.

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