

Regulating sound for the built environment of Indonesian urban areas

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ARTICLE INFO	ABSTRACT
<p>Article history: Received December 08, 2022 Received in revised form Dec. 23, 2022 Accepted January 06, 2023 Available online April 01, 2023</p> <p>Keywords: City Noise Regulation Sound Urban environment</p>	<p>Like other developing countries where traffic is a significant sound nuisance, traffic in Indonesian urban areas is boisterous. How this condition is regulated by the Indonesian government so that the community can live healthily and comfortably is a very crucial issue. Unfortunately, Indonesia has not had any sound environmental improvement since the regulation was enacted. Additionally, regulators and government officers who run the rule carelessly worsen the condition. This study aims to study how sound is regulated in Indonesia's central and local governments, what types of sound or noise and levels are covered, and whether recent local regulations have been enacted to regulate sound in Indonesian cities. The study mainly uses quantitative, i.e., snowball or chain referral sampling techniques, to collect sound regulations applied in ten large and busy cities in Indonesia. Then, the qualitative stage was conducted based on the content of the rules. The data shows that the Indonesian government at both the central and regional levels does not have legal standing to regulate noise caused by the absence</p>

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of noise regulation at the statutory level that can force those who violate the law to be punished. The only regulation is by the Minister of Environment, dated 1996, which is referenced nationally and adopted by most cities without or with minor modifications. This study found that (1) six of the ten cities regulate only one type of noise among various types of noise, (2) twelve of the 35 local regulations incorporate noise regulations into air pollution regulations instead of stand-alone regulations, (3) because provinces and cities adopt central regulations, the lowest noise level follows the central standard at 55 dB for settlement area without specific frequency ranges, (4) there is no straightforward procedure on how measurements to be carried out except in regulations stipulated by Yogyakarta province. There is also a fact that a standardized procedure for measuring noise is vital to be included in the regulation because unskilled government officials collected invalid data in dealing with a noise complaint leading to an unresolved situation.

Introduction

Sound disturbances, or people named noise, were prevalent in many countries when the industrial revolution began. [Simpson and Bruce \(1981\)](#) have reported that in 1981, the U.S. Environmental Protection Agency (EPA) estimated that nearly 50% of the U.S. population was exposed to high levels of traffic noise that are hazardous to health. The U.S. EPA recommends an average 24-hr exposure limit of 55 A-weighted decibels (dBA), with a 10-dBA penalty applied to night-time, to protect the public from all adverse effects on health and welfare in residential areas ([US EPA 1974](#)). But [Hammer, Swinburn, & Neitzel \(2014\)](#) reported that only a few communities, including city authorities, still consider noise's health risks in their policymaking. Meanwhile, in the European Region, it was reported that noise is one of the most critical environmental risks to health, with 100 million people in the E.U. affected by road traffic noise ([Zambrano-Monserrate and Ruano 2019](#)). The fact has triggered a growing concern among policymakers and the public alike. In 1999 the World Health Organization set a 55 dB(A) standard for the outdoor area, including residential and school sites ([WHO 1999](#)). It was then updated 10 years later, where more detailed health risks, procedures, and lowered standards were stipulated at 40 dB(A) for night noise ([WHO 2009](#)).

In developed countries, where noise regulations are well established, and public awareness of noise is high, policy-makers continuously keep their concern for improving these conditions. For example, in 2011 and 2018, the WHO announced 55 dB is a noise level that

the human ear can tolerate without changing its health ([WHO 2011](#); [WHO 2018](#)). But many countries exceed this level, especially developing countries ([Shaikh 1999](#)). For example, studies in India, Nepal, Pakistan, and Nigeria showed high noise levels in their urban areas, minimum statutory regulations, and citizen unawareness ([Singh and Davar 2004](#); [Chauhan, Shrestha, and Khanal 2021](#); [Mehdi et al. 2011](#); [Munir et al. 2021](#); [Usikalu and Kolawole 2018](#)), and minimal noise data ([Shaikh 1999](#))

Like India, Nepal, Pakistan, Nigeria, and other developing countries, traffic is a significant noise source in Indonesia. Noisy neighborhoods have never gotten better and are increasing in recent years due to traffic and community noise. The Indonesian Government has established a noise regulation to be referred to at the national level, namely the rule of the Minister of Environment dated 25 years ago: 1996. However, this regulation is outdated and has proven to be biased in its implementation ([Kementerian Lingkungan Hidup 1996](#); [Pengadilan Tata Usaha Negara 2021](#)). With outdated, unclear terms and procedures, and unskilled operators, it needs to have the power to regulate urban noise. Coupled with the people's unawareness ([Doygun and Gurun 2008](#)), a worse noise condition is unlikely. According to [Brown, Lam, and Van Kamp \(2015\)](#), the development of policies and management responses to noise risk requires, among other things, knowledge of the prevalence of road traffic noise exposure and the relationship between exposure and its human effects. How developed countries and the WHO rule noise show that managing sound requires consistency and continuity. It should be referred to by

countries that need to adequately set noise regulations to promote health and comfort for their citizens. This study aims to study how noise regulations are enacted in Indonesia's central and local governments, what types of noise and levels are covered, and whether current local rules have been enforced to regulate noise in Indonesian cities.

Theoretical approach

Different cities, provinces, and countries may have different noise regulations, given various sources of sound, education, awareness, culture, and social life. However, there are standards or recommendations from the World Health Organization (WHO) that can be referred to worldwide. The WHO has set several recommendations regarding noise, such as an outside night-time noise limit of 40 dB Lnight, outside with an interim target of 55 dB Lnight, outside (WHO 2009). The night outside standard is essential for residential areas because people generally spend more time at home than in other places where they want a controlled and safe environment, especially at night (Easthope 2004). In addition, many studies have shown that noise disturbance, especially at night, is an adverse psychological reaction to noise (Brown, Lam, and Van Kamp 2015; Dratva et al. 2010; Ouis 2001; Guski, Felscher-Suhr, and Schuemer 1999).

Fifty-five dB is the most common standard level adopted by most countries as the Lden (day evening night). Still, many have the additional penalty of 5 dB(A) for evening noise and 10 dB(A) for night-time noise, such as in the European Union (EEC 2002; Council Directive 2002; EEA 2014). Evening time is stipulated at 19.00 to 23.00 and night time is at 23.00 to 07.00. It is noise levels in front of building façades or just before entering the façade that is considered, which is clearly stated in the regulation "a quiet façade is the façade of a dwelling at which the value of Lden four meters above the ground and two meters in front of the façade, for the noise emitted from a specific source, is more than 20 dB lower than at the façade having the highest value of Lden." The law also stipulates that for reporting noise issues, the 55- and 65-dB contours must also be displayed on one or more maps that provide information about the location of villages, towns, and agglomerations within the contour. All the necessary details are clearly stated in the rules to minimize bias, unlike current Indonesian regulation, which has no details about measuring

and reporting noise (Kementerian Lingkungan Hidup 1996; Pengadilan Tata Usaha Negara 2021). The European regulation clearly attempted to protect residents of premises from the outside condition. With sufficient façade insulation, indoor quietness could be achieved; however, the outside noise is already at a low level if it is not. The crystal-clear regulatory law is an ideal reference to be adopted by countries that intend to regulate noise to provide better health and comfort for their citizens. Unfortunately, it is not the case in Indonesia, where regulations seem outdated and biased, making sound in urban areas too boisterous to support health and comfort. There has yet to be a study to investigate how noise regulation is enforced other than reports that Indonesia is noisy (Columbijn 2007; Hustim and Fujimoto 2012; Mediastika 2000; Mediastika et al. 2020). Study about sound and noise in Indonesia is scarce.

Method

The study was conducted using literature reviews of the present and past rules that existed in Indonesia. The data was collected online by searching available information on the internet and a slightly offline method by confirming the available archive to the affiliated regional government institutions. Data were collected from ten large Indonesian cities, i.e., Medan, Palembang, Jakarta, Bandung, Yogyakarta, Surabaya, Banjarmasin, Makassar, Denpasar, and Kupang. The ten cities are Provinces' capitals stretching from West to East of Indonesia. It is Sumatera Utara, Sumatera Selatan, Daerah Khusus Ibukota, Jawa Barat, Daerah Istimewa Yogyakarta, Jawa Timur, Kalimantan Selatan, Sulawesi Selatan, Bali, and Nusa Tenggara Timur, respectively. Since the past regulations were not accessible and there is no archive available, snowball sampling or chain referral sampling alike technique was used. Chain-referral sampling is defined as a sampling technique in which the samples have traits that are rare to find. In using this technique, existing data provide referrals to collect further data required for the study (Biernacki and Waldorf 1981). The past regulations were collected from the current rules that usually mention the past laws they referred to. Central and local data collected from 10 cities were analyzed qualitatively based on the content

of the rules using data reduction and coding (open and selective). First, open coding was used to classify objects or functions covered by the regulations. Then, selective coding was employed to identify the primary category of classification. Finally, the data were analyzed quantitatively using modest statistical methods, such as sum and average, to determine the trend or mode of objects or functions mentioned in the regulations.

Result and discussion

Regulations collected from ten cities are tabulated in [figure 1](#), [figure 2](#), and [table 1](#), classifying the time frame, measurement parameters, and objects covered in the rules. Eighteen types of urban functions are classified about the sound to be regulated. For types 7, 8, and 18, there is an overlap between slightly different functions and different sound sources. [Figure 1](#) shows that concerning the timeline, the 1926 rule is the oldest regulation about noise. It was established during Dutch colonialism in 1926, namely the nuisance law. The law stipulates that people can build small workplaces or companies as long as these activities require 3 kilowatts of electricity. However, if it starts to cause a nuisance, including noise, the person in charge must apply for a permit from the government. The term 'nuisance including noise' can become very subjective if it is not followed by additional information about the level of disturbance and to what degree. It is difficult to assess whether a commercial activity referred to in the regulation can be categorized as a public nuisance. Therefore, even if people have to ask permission from the authorities, it does not guarantee people apply as long as they feel that their activities cause no disturbance. It seems that the loose law of 1926 inspired the birth of lax and unspecified regulations.

[Table 1](#) shows 35 local noise regulations currently run in ten cities. By looking into the detail of regulation titles, 12 of the 35 regulations regulate air pollution or gas emission, with noise articles listed. The twelve rules do not explicitly and specifically restrict noise. Jakarta, Yogyakarta, Denpasar, and Palembang were found to regulate sound in more functions at the provincial and city levels than other cities. It is no wonder that Jakarta controls 15 objects because it is the capital & a metropolitan city, where many activities are carried out to support

the needs of the city's residents. However, it is interesting to know that Surabaya, as the second-largest metro city after Jakarta, does not manage objects like Yogyakarta, Denpasar, and Palembang. Ironically, Surabaya, famous for its well-managed parks and public facilities, does not restrict noise in public facilities but traffic noise instead. Most cities also only use sound pressure level (SPL) as a measurement parameter, which is not entirely in line with the national regulation of the Minister of Environment. Since environmental issues are under the responsibility of the Minister of Environment, the central regulation by the Minister of Environment is the only regulation referred to for sound and noise management in Indonesia. Indonesia has an older law by the Minister of Health dated 1987, which regulates noise with more stringent standards ([Kementerian Kesehatan 1987](#)). However, because the Minister of Health is not responsible for the environment, the 1987 regulation does not generally apply in Indonesia. Using the noise regulation by the Minister of Environment dated 1996 ([Kementerian Lingkungan Hidup 1996](#)), the lowest permissible noise is at 55 dBA as the 24-hour day-night equivalent index (LDN) for settlement areas. Whereas in the Minister of Health regulation, the lowest standard is 45 dBA plus a clause that the recommended limit is 35 dBA for zone A (research centers, hospitals, and similar functions). Ironically, the regulation referred to nationally is looser than the previous. There is also a regulation of the Minister of Manpower dated 1999, which regulates noise in the workplace only ([Kementerian Tenaga Kerja 1999](#)).

[Figure 2](#) helps us learn that most rules set by the local government to regulate sound or noise only cover a type of object or function (6%, which means 1 per 18), mostly related to noise from vehicles (traffic). Whereas [Table 1](#) shows that in most cities, only the SPL is stipulated in the regulations, without a detailed appendix on measuring it. [Rusjadi and Palupi](#) demonstrated the procedure for setting the sound level meter for valid measurements. They showed that measurement in Leq of 10 minutes' mode is crucial to determine whether the noise is acceptable or above the standard ([Rusjadi and Palupi 2011](#)). Ten minutes is the minimum duration to represent noise over a certain period (hours or a sum of several hours). There is evidence that the unskilled Surabaya Environmental Agency (Bahasa Indonesia: Dinas

Table 1. Tangible aspects

City	Regional Regulations	Time frame	Measuring parameters		Objects or functions covered by the regulations																		
			L _{eq} dB(A)	L _{max} dB(A)	SPL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Bandung	PerDa Kota Bandung No.18/2011 (1)	2011 - 2031			*	*				*				*								*	
	PerDa Kota Bandung No.05/2010 (2)	2010			*	*																	
	PerDa Kota Bandung No.11/2006 (3)	2006			*																	*	
	PerWali Bandung No. 572 (4)	2010			*																		*
Banjarmasin	PerDa KalSel No.9 2015 (5)	2015 - 2035			*	*				*					*								
	PerDa Kota Banjarmasin No.15/2012 (6)	2012			*																		*
Denpasar	PerGub Bali No.8/2007 (7)	2007	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	PerGub Bali No.16/2016 (8)	2016	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	PerDa Prov Bali No.16/ 2009 (9)	2009 - 2029			*				*					*	*								
	PerDa Kota Denpasar No.27/2011 (10)	2011 - 2031			*	*			*					*	*								
	PerDa Prov Bali No.1/ 2017 (11)	2017			*																		
	PerDa Prov Bali No.4/ 2016 (12)	2016			*																		*
Jakarta	KepGub Prov DKI No.551/2001 (13)	2001	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	PerDa Prov DKI No.15/2011 (14)	2011			*	*							*	*	*								
	PerGub DKI No.25/2016 (15)	2016			*																		*
	PerGub DKI No.101/2013 (16)	2013			*	*	*						*	*	*								
Kupang	PerDa Kota Kupang No.12/2011 (17)	2011 - 2031			*	*																	
	PerDa Kota Kupang No.7/ 2015 (18)	2015			*																	*	
	PerDa Kota Kupang No.6/ 2017 (19)	2017			*																		*
Makassar	PerDa Kota Makassar No.9/2016 (20)	2016			*																		*
	PerDa Kota Makassar No.15/2009 (21)	2009			*								#										
	PerDa Prov SulSel No.3/ 2014 (22)	2014			*																		*
Medan	PerDa Kota Medan No.13/ 2003 (23)	2003			*									*									
	PerDa Kota Medan No.9/ 2016 (24)	2016			*								#										
	PerDa Kota Medan No.5/ 2016 (25)	2016			*	*							*	*									*
	PerDa Prov SumUt No.2/ 2011 (26)	2011			*																		*
Palembang	PerDa Prov SumSel No.1/ 2012 (27)	2012	*											*									
	PerDa Prov SumSel No.8/ 2013 (28)	2013			*																		*
	PerGub SumSel No.17/ 2005 (29)	2005	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Surabaya	PerDa Kota Surabaya No.3/2008 (30)	2008			*								#										
	PerDa Prov JaTim No.3/ 2008 (31)	2008			*								#										
	PerWali Surabaya No.1/2015 (32)	2015			*								*										
	PerWali Surabaya No.25/2014 (33)	2014			*									*									
Yogyakarta	KepGub DIY No.176/2003 (34)	2003	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	PerGub DIY No.40 2017(35)	2017	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Notes		
1 = Hospital	7 = Public facility/ [#] Traffic	13 = Seaport
2 = Residential area	8 = Commerce/ [#] Market	14 = Cultural heritage
3 = Green open space	9 = Industry	15 = Bus station
4 = School	10 = Amusement/recreational area	16 = Open space (non-green)
5 = Religious building	11 = Airport	17 = Building
6 = Office	12 = Train station	18 = Vehicle/ [#] Loud speaker

Table 2. Regulatory compliance at the provincial and city levels with the current national regulation

City	Compliance with noise regulation of Minister of Environment No.48 dated 1996	
	Regulation at province level	Regulation at city level
Bandung	No	No
Banjarmasin	No	No
Denpasar	No	Yes ^{1,2}
Jakarta	No	Yes ³
Kupang	No	No
Makassar	No	No
Medan	No	No
Palembang	Yes ⁴	No
Surabaya	No	No
Yogyakarta	Yes ^{5,6}	No

Notes	
1 = Peraturan Gubernur Bali No.8/2007	4 = Peraturan Gubernur Sumatera Selatan No.17/ 2005
2 = Peraturan Gubernur Bali No.16/2016	5 = Peraturan Gubernur DIY No.40 2017
3 = Keputusan Gubernur DKI Jakarta No.551/2001	6 = Keputusan Gubernur DIY No.176/2003

According to [Firmansyah and Evendia \(2014\)](#), setting environmental quality standards is a prevention instrument. Environmental pollution is one form of the chosen legal government policy concerning environmental matters. Regulations are ordered from the strongest: laws, government regulations, ministerial regulations, to provincial and city ordinances. The stipulation of environmental quality standards as an instrument for preventing ecological pollution is known as responsive law. [Nonet and Selznick \(2001\)](#) said responsive laws are set as responses to various social needs and aspirations. However, more than the stipulation of environmental quality standards as a response to legal requirements in society then poured into written text is required to ensure good environmental quality.

[Rahardjo \(2009\)](#) said many things that are not contained in written texts, such as the atmosphere and needs that existed at a time and the morals that society embraced at a specific time, are impossible to be recorded in the legal text. Therefore, it is necessary to develop comprehensive environmental law to develop the national legal system. Such extensive action is needed to comply with community law and apply the rule of law. It is necessary to stipulate strict laws and regulations by enforcing environmental

laws to fulfill environmental quality standards. Law enforcement can be carried out in two ways preventively and repressively. The preventive stage is to ensure that the community complies with regulations and repressively through the provision of sanctions or court proceedings in the event of violating the rules. Theoretically, local governments also participate in setting environmental quality standards applicable to the region. The provisions of the established quality standards at the regional level must be more stringent than in the national setting ([Rahardjo 2009](#)).

More importantly, regulatory laws are ideally in the form of law as the highest level of legislation and updated over a certain period to accommodate humans' needs. It should be acknowledged that individual noise perception varies between persons and that the same person's perception changes over time. Also, as a subjective matter, noise perception is not only determined by sound pressure level but also upon the quality and context of the sound stimulus, current activity, and engagements of the recipient, individual temperament, cognitive style, state of mind and health, level of control over the sound stimulus, attitude toward the sound source, etc. ([Westman and Walters 1981; Basner et al. 2014](#)).

In addition, Okokon et al. (2018) suggest that the mental health effects of noise may be significant. Therefore, noise regulations should be updated frequently, considering possible psychological and physiological effects. The updated law is enacted as a responsive law concerning the social needs and aspirations of the community.

Conclusion

A study of how noise is regulated in Indonesia's noisy cities shows that Indonesia has implemented outdated and lax regulations since 1996. The outdated Minister of Environment's regulation that serves as a central reference for how noise is managed in Indonesia is not supported by stringent local noise regulations at the provincial and city levels. This study summarises that (1) six of the ten cities regulate only one type of noise among various types of noise, (2) twelve of the 35 local regulations incorporate noise regulations into air pollution regulations instead of stand-alone regulations, (3) because provinces and cities adopt central regulations, the lowest noise level follows the central standard at 55 dB for settlement area without specific frequency ranges, (4) there is no straightforward procedure on how measurements to be carried out except in regulations stipulated by Yogyakarta province.

A case in Surabaya is a fact that the correct procedure is vital to be included in the regulations. Furthermore, noise data should be collected by skilled laboratory assistants, not random government officials. The conclusions drawn from this study indicate that sound, in particular noise, needs to be correctly and adequately regulated in Indonesia. This causes noise to increase over time, followed by a decrease in public health and comfort levels. Therefore, Indonesia needs new stringent noise regulations covering psychological and physical community risks, managed objects or functions, measurement procedures, skilled operators, and strict sanctions for violators. It is suggested in the form of law or legislation instead of minister regulation which has no power to punish violators.

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