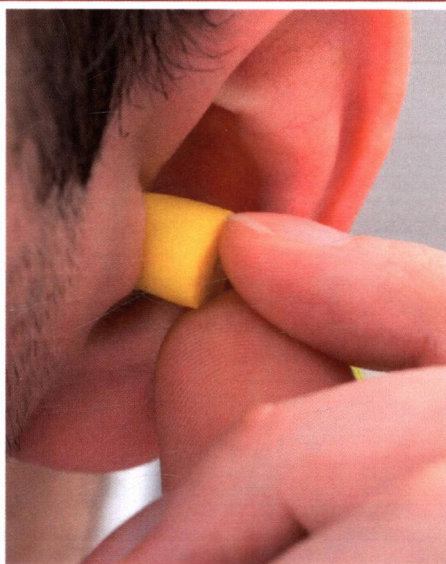


Noise Pollution and Control



Noel Templeton

Noise Pollution and Control

The rise in vehicles, engines, motors, acoustic devices and other factors are causing noise pollution to increase at an alarming rate. Pollution is highly detrimental to our environment. Thus, its control and prevention are crucial. The book is designed to provide the students some fundamental concepts of noise pollution and its control. It contains chapters that deal with the causes of pollution and the various technologies to control it. The book studies, analyses and upholds the pillars of this subject and its utmost significance in modern times. It is compiled in such a manner that it will provide in-depth knowledge about the theory and practice of this field. This textbook is meant for students who are looking for an elaborate reference text on noise pollution and control.

Noel Templeton received his Post Graduate certificate degree in Environmental Noise Measurement from University of Derby, United Kingdom. His academic interests lie in noise disturbance, environmental noise measurement and noise-induced hearing loss. Templeton has been the recipient of two awards for his research work in the field of noise regulation and noise awareness. He is an active member of several scientific and technical societies, where he continues to share his expertise and knowledge in the fields of noise pollution and its control measures.

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Edited by
Noel Templeton

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Noise Pollution and Control

Preface

The rise in vehicles, engines, motors, acoustic devices and other factors are causing noise pollution to increase at an alarming rate. Pollution is highly detrimental to our environment. Thus, its control and prevention are crucial. The book is designed to provide the students some fundamental concepts of noise pollution and its control. It contains chapters that deal with the causes of pollution and the various technologies to control it. The book studies, analyses and upholds the pillars of this subject and its utmost significance in modern times. It is compiled in such a manner that it will provide in-depth knowledge about the theory and practice of this field. This textbook is meant for students who are looking for an elaborate reference text on noise pollution and control.

To facilitate a deeper understanding of the contents of this book a short introduction of every chapter is written below:

Chapter 1- Excessive noise that causes discomfort and potential physical harm is known as noise pollution. Noise pollution is mainly caused by machines and by transportation systems. It is increasingly becoming a cause of concern for environmentalists all across the world as high levels of noise can result in the death of animals and also certain disabilities in humans.

Chapter 2- This chapter elucidates on certain examples of noise pollution such as noise caused by industries, roadway noise, jet noise, aircraft noise and environmental noise. Noise pollution is as important to deal with as air pollution or water pollution. Understanding noise pollution is necessary if we want to control it in time. Noise pollution is best understood in confluence with the major topics listed in the following chapter.

Chapter 3- To mark a difference between sound and noise we need some level of measurement. Sound exposure level and sound intensity level are two levels explained within this chapter. The following section helps in providing the reader with an in-depth understanding of the subject matter.

Chapter 4- Noise pollution has certain effects on the environment as well as an individual. Some of these effects are hearing problems, cardiovascular issues, sleeping disorders and tinnitus. Animals also face problems because of noise pollution as the frequency of their hearing is higher. The effects may not be felt strongly on a day-to-day basis, but it can be very damaging in the long run. This section helps the readers in understanding the effects produced by noise pollution.

Chapter 5- There are few technologies that can prevent noise pollution. Some of them are construction of soundproof rooms for noisy machines, absorption and vibration isolation. Excessive noise can affect psychological health, cause sleeping disorders and can also cause death in animals. This chapter has been carefully written to provide an easy understanding of noise control.

Chapter 6- Sound is the vibration that is audible and travels through a medium such as air or water. Elements such as pitch, duration, loudness, timbre and sound localization can analyze sound. In order to completely understand sound it is necessary to understand the properties related to it.

Chapter 7- Audiology is a branch of science that studies topics such as hearing and the disorders related to hearing. The aspects explained in the following section are audiometers, audiograms, audiometrists, audiometry and pure tone audiometry. This section is an overview of the subject matter incorporating all the main features of audiology.

I would like to share the credit of this book with my editorial team who worked tirelessly on this book. I owe the completion of this book to the never-ending support of my family, who supported me throughout the project.

Editor

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Introduction to Noise Pollution

Excessive noise that causes discomfort and potential physical harm is known as noise pollution. Noise pollution is mainly caused by machines and by transportation systems. It is increasingly becoming a cause of concern for environmentalists all across the world as high levels of noise can result in the death of animals and also certain disabilities in humans.

Noise Pollution

Noise pollution or noise disturbance is the disturbing or excessive noise that may harm the activity or balance of human or animal life. The source of most outdoor noise worldwide is mainly caused by machines and transportation systems, motor vehicles, aircraft, and trains. Outdoor noise is summarized by the word environmental noise. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas. Documented problems associated with urban noise go back as far as Ancient Rome.



Traffic is the main source of noise pollution in cities.

Outdoor noise can be caused by machines, construction activities, and music performances, especially in some workplaces. Noise-induced hearing loss can be caused by outside (e.g. trains) or inside (e.g. music) noise.

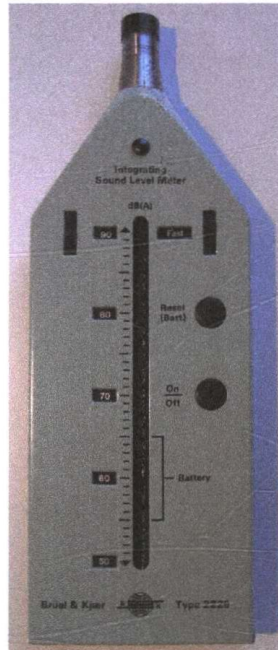


A Qantas Airways Boeing 747-400 passes close to houses shortly before landing at London Heathrow Airport.

High noise levels can contribute to cardiovascular effects in humans and an increased incidence of coronary artery disease. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and contribute to permanent hearing loss.

Health

Humans



A sound level meter, a basic tool in measuring sound.

Noise pollution affects both health and behavior. Unwanted sound (noise) can damage psychological health. Noise pollution can cause hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects.



Reaction to noise

Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life.

Chronic exposure to noise may cause noise-induced hearing loss. Older males exposed to significant occupational noise demonstrate more significantly reduced hearing sensitivity than their non-exposed peers, though differences in hearing sensitivity decrease with time and the two groups are indistinguishable by age 79. A comparison of Maaban tribesmen, who were insignificantly exposed to transportation or industrial noise, to a typical U.S. population showed that chronic exposure to moderately high levels of environmental noise contributes to hearing loss.

High noise levels can result in cardiovascular effects and exposure to moderately high levels during a single eight-hour period causes a statistical rise in blood pressure of five to ten points and an increase in stress, and vasoconstriction leading to the increased blood pressure noted above, as well as to increased incidence of coronary artery disease.

Less addressed is how humans adapt to noise subjectively. Indeed, tolerance for noise is frequently independent of decibel levels. However, Murray Schafer's soundscape research was groundbreaking in this regard. In his eponymous work, he makes compelling arguments about how humans relate to noise on a subjective level, and how such subjectivity is conditioned by culture. He also notes that sound is an expression of power, and as such, material culture (e.g., fast cars or Harley Davidson motorcycles with aftermarket pipes) tend to have louder engines not only for safety reasons, but for expressions of power by dominating the soundscape with a particular sound. Other key research in this area can be seen in Fong's comparative analysis of soundscape differences between Bangkok, Thailand and Los Angeles, California, US. Fong's research methodology was modeled after Schafer, and the research findings show how not only

do soundscapes differ, but they also rather explicitly point to the level of urban development in the area; that is, cities in the periphery - in Immanuel Wallerstein-speak - will have different soundscapes than that of cities in the core. Fong's important findings tie not only soundscape appreciation to our subjective views of sound, but also demonstrates how different sounds of the soundscape are indicative of class differences in urban environments.

Wildlife

Noise can have a detrimental effect on wild animals, increasing the risk of death by changing the delicate balance in predator or prey detection and avoidance, and interfering the use of the sounds in communication, especially in relation to reproduction and in navigation. Acoustic overexposure can lead to temporary or permanent loss of hearing.

An impact of noise on wild animal life is the reduction of usable habitat that noisy areas may cause, which in the case of endangered species may be part of the path to extinction. Noise pollution may have caused the death of certain species of whales that beached themselves after being exposed to the loud sound of military sonar.

Noise also makes species communicate more loudly, which is called Lombard vocal response. Scientists and researchers have conducted experiments that show whales' song length is longer when submarine-detectors are on. If creatures do not "speak" loudly enough, their voice will be masked by anthropogenic sounds. These unheard voices might be warnings, finding of prey, or preparations of net-bubbling. When one species begins speaking more loudly, it will mask other species' voice, causing the whole ecosystem eventually to speak more loudly.

Marine invertebrates, such as crabs (*Carcinus maenas*), have also been shown to be negatively affected by ship noise. Larger crabs were noted to be negatively affected more by the sounds than smaller crabs. Repeated exposure to the sounds did lead to acclimatization.

European robins living in urban environments are more likely to sing at night in places with high levels of noise pollution during the day, suggesting that they sing at night because it is quieter, and their message can propagate through the environment more clearly. The same study showed that daytime noise was a stronger predictor of nocturnal singing than night-time light pollution, to which the phenomenon often is attributed.

Zebra finches become less faithful to their partners when exposed to traffic noise. This could alter a population's evolutionary trajectory by selecting traits, sapping resources normally devoted to other activities and thus leading to profound genetic and evolutionary consequences.

Noise Mitigation



The sound tube in Melbourne, Australia is designed to reduce roadway noise without detracting from the area's aesthetics

Roadway noise can be reduced by the use of noise barriers, limitation of vehicle speeds, alteration of roadway surface texture, limitation of heavy vehicles, use of traffic controls that smooth vehicle flow to reduce braking and acceleration, and tire design. An important factor in applying these strategies is a computer model for roadway noise, that is capable of addressing local topography, meteorology, traffic operations, and hypothetical mitigation. Costs of building-in mitigation can be modest, provided these solutions are sought in the planning stage of a roadway project.

Aircraft noise can be reduced by using quieter jet engines. Altering flight paths and time of day runway has benefitted residents near airports.

Industrial noise has been addressed since the 1930s via redesign of industrial equipment, shock mounted assemblies and physical barriers in the workplace. In recent years, Buy Quiet programs and initiatives have arisen in an effort to combat occupational noise exposures. These programs promote the purchase of quieter tools and equipment and encourage manufacturers to design quieter equipment. The US National Institute for Occupational Health has created a database of industrial equipment with decibel levels noted.

Legal Status

Up until the 1970s governments tended to view noise as a "nuisance" rather than an environmental problem.

Many conflicts over noise pollution are handled by negotiation between the emitter and the receiver. Escalation procedures vary by country, and may include action in conjunction with local authorities, in particular the police.

India

Noise pollution is a major problem in India. The government of India has rules & regulations against firecrackers and loudspeakers, but enforcement is extremely lax. Awaaz (sound) Foundation is an Indian NGO working to control noise pollution from various sources through advocacy, public interest litigation, awareness, and educational campaigns since 2003. Despite increased enforcement and stringency of laws now being practised in urban areas, rural areas are still affected.

United Kingdom

Figures compiled by rockwool, the mineral wool insulation manufacturer, based on responses from local authorities to a Freedom of Information Act (FOI) request reveal in the period April 2008 – 2009 UK councils received 315,838 complaints about noise pollution from private residences. This resulted in environmental health officers across the UK serving 8,069 noise abatement notices or citations under the terms of the Anti-Social Behaviour (Scotland) Act. In the last 12 months, 524 confiscations of equipment have been authorized involving the removal of powerful speakers, stereos and televisions. Westminster City Council has received more complaints per head of population than any other district in the UK with 9,814 grievances about noise, which equates to 42.32 complaints per thousand residents. Eight of the top 10 councils ranked by complaints per 1,000 residents are located in London.

United States

There are federal standards for highway and aircraft noise; states and local governments typically have very specific statutes on building codes, urban planning, and roadway development.

Noise laws and ordinances vary widely among municipalities and indeed do not even exist in some cities. An ordinance may contain a general prohibition against making noise that is a nuisance, or it may set out specific guidelines for the level of noise allowable at certain times of the day and for certain activities.

The Environmental Protection Agency retains authority to investigate and study noise and its effect, disseminate information to the public regarding noise pollution and its adverse health effects, respond to inquiries on matters related to noise, and evaluate the effectiveness of existing regulations for protecting the public health and welfare, pursuant to the Noise Control Act of 1972 and the Quiet Communities Act of 1978.

New York City instituted the first comprehensive noise code in 1985. The Portland Noise Code includes potential fines of up to \$5000 per infraction and is the basis for other major U.S. and Canadian city noise ordinances.