Computing the Noise Level in Commercial Areas

C. Anupama

(12PIR003)

A Thesis Submitted To The

Avinashilingam Institute for Home Science and Higher Education for Women,
Coimbatore – 641043

In Partial Fulfilment of the Requirement for the Degree of Master of Science

Interior Design and Resource Management

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Certified As Bonafide Research Work

31/3/14

Signature of the Guide

31/3/14

Signature of the Head of the Department

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"Sometimes our light goes out but is blown into flame by another human being. Each of us owes deepest thanks to those who have rekindled this light."

Albert Schweitzer

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INTRODUCTION

"All noise is waste. So cultivate quietness in your speech, in your thoughts, in your emotions. Speak habitually low. Wait for attention and then you low words will be charged with dynamite."

Elbert Hubbard

Environmental Pollution is a major global concern of the day. In India too we are facing lot of environmental problems. Common public in general and young generation in particular should come forward to reduce this burning issue of pollution and to protect our environment (Bhat, 2010). The present generation and the coming generations have to solve three grave problems, namely population poverty and pollution if they have to survive. Pollution being the most dangerous problem likes cancer in which death is sure but slow. Environment pollution is assuming dangerous proportions all through the globe and India is not free from this poisonous disease. This is the gift of modern living, industrialization and urbanization. Unless timely action is taken we have to forbid and bleak future for the world (Miglani, 2000).

As a result of increasing mechanization, the use of increasingly voluminous and complicated machinery and equipment and the stepping up of the pace of production, the noise is becoming an increasingly wide- spread and serious source of discomfort and danger. Noise is a well-known source of pollution in urban and work environments (Zannin et al Sant'Ana, 2011). According to the environmental protection act, "the presence of substance in the environment that, because of its chemical composition or quantity, prevents the functioning of natural processes and produces undesirable environmental and health effects is called noise. The noise originates from human activities, especially the urbanization and the development of transport and industry. Though, the urban population is much more affected by such pollution, however, small town/villages along side roads or industries are also victim of this problem. Though noise pollution is a

slow and subtle killer, yet very little efforts have been made to ameliorate the same. It is, along with other types of pollution has become a hazard to quality of life (Singh et al Dawar, 2004).Noise is a well- known source of pollution in urban and work environments (Zannin and Sant' Ana, 2011).

Sound is essential to our daily lives, but noise is not. Noise is generally used as an unwanted sound, or sound which produces unpleasant effects and discomfort on the ears. Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life. Not all noise can be called noise pollution. If it does not happen regularly, it may be termed as 'Nuisance'. Scientists also believe that it's not only humans who are affected. Water animals are subjected to noise by submarines and big ships on the ocean, and chain-saw operations by timber companies also create extreme noise to animals in the forests. Generally, noise is produced by household gadgets, big trucks, vehicles and motorbikes on the road, jet planes and helicopters hovering over cite and loud speakers. Noise (or sound) is measured in the units of decibels and is denoted by the dB. Noise which is more than 115 dB is tolerant. The industrial limit of sound in the industries must be 75 dB according to the World Health Organization. Noise is considered as environmental pollution, even though it is thought to have less damage on humans than water, air or land pollution. But people who are affected by severe noise pollution know that it is a massive issue that needs attention (http://eschooltoday.com/).

Noise as a physical pollutant is not easily recognized. This is because the sensitivity of human ear gets automatically adjusted to the ambient level of sound and so slow increases in the ambient level go unnoticed. Therefore, noise continues to do the damage silently. Pollution, in general, is a by-product of some essential function or activity. Therefore it is almost impossible to completely eliminate the pollutant, but it can be controlled or reduced. Most of the pollutants can be tolerated only up to a certain level, the level being dependent on the type of the pollutant. When the level of pollution continues to increase, it becomes necessary to know the amount by which the permissible limit has been exceeded so that their increase can be checked by the introduction of suitable regulations. To know

the level of pollution the pollutant has to be measured. In the case of noise pollution, measurement is all the more essential because of the incapability of our auditory system to recognize slow changes (Sampath, 2004).

Some consider certain instances of human voices or animal sounds to be unwanted noise, but those sources are not acknowledged universally as noise pollution, as they are essentially natural sounds of the environment, unless amplified or produced in unreasonable proximity to others (Hogan and Latshaw, 2000).The perception of sounds in day-to-day life is of major importance for human wellbeing. Proportion of people exposed to noise is greatly increasing. This has direct and indirect affect to the people that can lead to the health hazard (Padhy and Padhi, 2008).

Noise is responsible for cochlear and general damages. Hearing loss and tinnitus greatly depend on sound intensity and duration. Sound levels of less than 75 dB (A) are unlikely to cause permanent hearing loss, while sound levels of about 85 dB (A) with exposures of 8 h per day will produce permanent hearing loss after many years. Popular and largely amplified music is today one of the most dangerous causes of noise induced hearing loss. The intensity of noises (airport, highway) responsible for stress and general consequences (cardiovascular) is generally lower. Individual noise sensibility depends on several factors. Strategies to prevent damage from sound exposure should include the use of individual hearing protection devices, education programs beginning with school-age children, consumer guidance, increased product noise labelling, and hearing conservation programs for occupational hazards (Chouard, 2011).

In India, the problem of noise pollution is wide spread. Several studies report that noise level in metropolitan cities exceeds specified standard limits. It is responsible for rising incidence of deafness among the inhabitants (Bhargawa, 2001). Many noise surveys treating the problem of noise pollution in many cities throughout the world have been conducted. In some surveys such as in noise impact was treated as a stress inductor, and in consequence the role of noise as a risk factor for human health is discussed.

Maschke says that the induced stress by noise has a psychosocial component (Zannin, 2002).

Primary sources of noise include road and rail traffic, air transportation and occupational and industrial activities (NAE 2010). Additional individual level exposures include amplified music, recreational activities (including concerts and sporting events), and firearms. Personal music player use appears to be common among adolescents (Kim et al. 2009; Vogel et al. 2011), and may involve potentially harmful levels (Breinbauer et al. 2012). Exposures from recreational activities and music are not “noise” in the sense of being unwanted sound, but adverse health effects is possible even from desirable sounds.

Surface motor vehicles, including automobiles, trucks and motorcycles, produce approximately 85 percent of all intrusive environmental noise; while there is a long term trend in quieter vehicles, the expanding human population demanding more use of surface transportation outweighs the slight downward trend in individual vehicle emissions. In the year 2010 the geographic extent of noise intrusion continues to reach new highs, as motor vehicle use continues to expand into previously quiet areas of the planet. Aircraft noise, while contributing lesser total energy into the environment, poses some of the greatest human health treats, due to the extremely high sound levels produced. Other sources of noise are industrial plants; amplified music; garden and power tools and garden power; sirens and alarms.

The harmful effects of noise on human health and development have been underestimated for a relatively long time. This may be due to the fact that noise endangers human health in an indirect manner, as opposed to other harmful substances in the workplace or environment. However, in contrast to some other environmental problems, noise pollution continues to increase, and with it we see an increasing number of complaints from those who are exposed (Berglund et al., 2000).

India has developed many rules and regulations from time to time to ensure that the noise levels in the country are maintained at a nominal level. As Motor Vehicles are the chief source of noise pollution, the Motor

Vehicle Act of 1998, gave numerous powers to the state Administration to monitor the noise levels at their own level. Although there have been many more provisions but as none of them have been implemented as they were supposed to be, the noise levels seems to be growing day by day

(http://www.indiaonline.in/).

The Supreme Court of India which is in New Delhi gave a significant verdict on noise pollution in 2005. Unnecessary honking of vehicles makes for a high decibel level of noise in cities. The use of loudspeakers for political purposes and for sermons by temples and mosques makes noise pollution in residential areas worse. In January 2010; Government of India published norms of permissible noise levels in urban and rural areas (Sahu, 2008).

The noise pollution, is dire enemy of human brain, is not a new phenomenon, but it is as old as civilization itself. Today its cry being heard very loudly from all the nooks and corners of the globe. It was conceived on the very day, when Adam dawned on this planet earth, but now the same has become a major threat to the peaceful life of today's mankind and to the very existence of wild-life and the properties. On one hand, the advancement of science and technology by providing us automobiles, electrical appliances, supersonic jets, spacecrafts, inventions for medicine, sound amplifiers, musical enjoyment parties, better chemicals to control harmful insects and other pests. On other hand, this process of progress has generated various environmental pollution to be faced and noise pollution is one of such major problems (Mahandiyan, 2006).

Noise in recent years has emerged as one of the important pollutants of environment. In fact, it needs some legislation for its control like the Air Pollution Act and Water Pollution Act but no legislation for it has yet been enacted despite the fact problem of noise is, in no way, less delicate than the problem of air and water pollution. No doubt, there are some Central and State enactments which directly or indirectly relate to the problem of noise; however, there is no specific legislation in India as in some other countries to meet the growing challenges of noise pollution on national level.

Noise has rather become a permanent feature in the normal life of the people. The noise carries its adverse effects on human health, animals and birds by way of causing various health hazards. Thus noise is poised to challenge to human survival. However, noise has been included within Section 2 of the Air Pollution Act and further under section 6(b) of the Environment Protection Act enabling the Central Government to enact the rules for the control of noise pollution. In pursuance thereof the Government notified Ambient Air Quality Standards in respect of noise. The Central Pollution Control Board has also approved Noise Standards for different sources of noise, which have not yet been notified by the Government. No doubt, these noise standards may be helpful in controlling the problem of noise to a greater extent; however, to control the rapid growth of noise in the country and to keep the environment noise-free for the people, some specific and strict legislation to solve the problem of noise pollution has become an urgent need of the day (Kumar et al, 2006).

Shopping malls, with remarkable increase in the number, are now one of the popular public spaces. They can be considered as “new driving forces” of economy as well as the new way of “socializing places” where visitors can experience different modes of interactions. Shopping malls are products of the collection of different elements of the retailing sector in an enclosed atmosphere and under a single managerial organization in order to supply consumers with one-stop shopping. Thus, in the rapid life of this century, these buildings become one of the preferred spaces for people to take part in life. Today’s shopping malls include not only the stores for shopping but also leisure areas such as cinemas, restaurants and playgrounds for social and cultural activity. Today shopping malls are public spaces where many people frequently spend time. Due to this heavy use, malls are one of the building types where comfort conditions have major importance. Noise is caused in shopping malls and complexes due to the musical and dancing events going on there, due to crowd in the mall and due to announcements made in the malls, due to heavy machines.

Since no study has been undertaken on “Computing the noise level in commercial areas” this initiated the investigator to take up a research

study on “Study of noise pollution in commercial areas of Coimbatore district” with following objectives to:

- Estimate the noise level in commercial areas.
- Study the major sources of noise pollution produced in commercial areas.
- Find out the measures adopted by the people to control noise pollution.
- Estimate the peak time of noise.
- Find out the age group mainly responsible for causing noise pollution.
- Study the major problems faced by people due to noise pollution.

It is hoped that the study would throw light on effects of noise pollution as well as sources of noise pollution and thereby adopting measures to bring safe environment for improving the quality of life of the people.

II. REVIEW OF LITERATURE

The literature pertaining to the study on “Computing the noise level in commercial areas” comprised of the following main headings:

A. Concept of noise pollution
B. Sources of noise pollution
C. Harmful effects of noise pollution
D. Prevention of noise pollution
E. Laws in India for controlling noise pollution

A. Concept of noise pollution

Noise pollution is a manmade sound that penetrates the environment. Noise pollution can be caused by many sources including highways; vehicles; police cars; ambulances; factories etc. In general noise pollution refers to any noise irritating to one’s ear which comes from external noise. Noise pollution is defined as “unwanted or offensive sound that unreasonable intrudes into our daily activities”. It has many sources, which are mostly associated with urban development: road, air and rail transport; industrial noise; neighbourhood and recreational noise. A number of factors contribute to problems of high noise level (Hiremath, 2006). Noise pollution refers to sounds in the environment that are caused by humans and that threaten the health or welfare of human or animal inhabitants. (http://www.noisehelp.com/)

Noise pollution, as a major contributor to the environmental pollution, is the creation of man himself. It is no less hazardous then the toxic chemicals it is shadowy public enemy whose growing menace has increased in Morden age of industrialization, scientific and technological progress of the society. As soon as person is born he or she comes in contact with noise pollution, may it be due to alarming bells, radio, televisions, loudspeakers, school bells, motor vehicles trains, industrial machineries and a lot of other objects which produce sounds of varying magnitude. Although, soft rhythmic

sound in the form of music and dance stimulates brain activities, removes boredom and fatigue, but the excessive of the same sound may prove detrimental to living things. Researchers have proven that a loud noise during peak marketing hours creates tiredness, irritation and impairs brain activities so as to reduce thinking and working abilities (Mahandiyan, 2006).

The noise pollution is defined as the unwanted sound which is released into the environment. It disturbs the human being and cause an adverse effect on the mental and psychological well being. It is measured in the units of decibels and is denoted by the dB. The noise which is more than 115 dB is tolerant. The industrial limit of sound in the industries must be 75 dB according to the world health organization. (http://www.thebigger.com)

Noise pollution refers to a type of energy pollution in which distracting, irritating or damaging sounds are freely audible. With this type of pollution, contaminants are not physical particles, but rather waves that interfere with naturally-occurring waves of a similar type in the same environment. Industries, automobiles and some entertainment joints are some of the sources of noise pollution (http://www.ask.com).The term Noise has been defined as a sound without agreeable musical quality or as an unwanted or undesired sound. Noise is no less a pollutant than the toxic chemicals in the environment. Definition given in the ILO Convention No. 148 is the term noise covers all the sound, which can result in hearing impairment or be harmful to health or otherwise dangerous (Garg, 2000).

Noise pollution is unwanted human-created sound. The word noise comes from the Latin word nausea meaning seasickness. The dominant form of noise pollution is from transportation sources, principally motor vehicles. The mechanism for chronic exposure to noise leading to hearing loss is well established. High noise levels can contribute to cardiovascular effects and rise in blood pressure. Noise pollution has dangerous effects on us as it causes deafness and loss of attention. Industries and automobiles are major causes of noise pollution. It is essential for us to reduce noise pollution (Chakhaiya, 2010).

B. Sources of noise pollution

According to Bhatia (2003) noise pollution is not only the result of human activities , but sound from various source like construction sites, radios, microphones, automobiles, airplanes , railways, irrigation pumps ,etc…,also affect the environment. There are numerous sources of noise pollution but it can be broadly classified into two classes.

Industrial source of pollution

Industrial source of pollution such noise pollution is caused due to operation of industries set up around cities, particularly a large number of small works commonly found in residential area. Noise pollution is also caused by the manufacturing process in industries. In addition , vehicular movements such as cars, motors ,trucks , trains ,motor cycles, aircrafts rockets , defence equipments , explosions , etc…., are also major sources of noise pollution.

Non -industrial sources of pollution

Non- industrial sources of noise pollution include street noise due to hawkers and modern household gadgets, such as mixer-cum-grinder, vacuum cleaner, washing machines, coolers and air conditioners. They enhance the levels sound and are potentially dangerous to health. The use of loud speakers and demonstrations, thunder, disturbs the peace of the locality. Similarly, loudly played radios, stereos, televisions are some of other major sources of noise pollution. Noise of dhol, dhapli, bigul and shankh has been in the root of our Indian Culture. There is hardly any religious ceremony or festival in India being performed without any noise. But due to the rapid growth of urbanization and industrialization, noise has become a serious challenge to the quality of life of the people in most of the industrialized countries.

According to Miglani 2010 the noise pollution has two sources, i.e. industrial and non- industrial. The industrial source includes the noise from various industries and big machines working at a very high speed and high noise intensity. Non- industrial source of noise includes the noise created by transport/vehicular traffic and the neighbourhood noise generated by various noise pollution can also be divided in the categories, namely, natural and

manmade. Most leading noise sources will fall into the following categories: roads traffic, aircraft, railroads, construction, industry, noise in buildings, and consumer products.

Road Traffic Noise: Noise comes from many sources; the most significant sources is from transportation, particularly traffic noise. Highway emanates from three sources: (a) the engine, (b) the exhaust, and (c) the friction vehicles of the tyres on the road. Once typical highway speeds are reached, the predominant noise from light trucks and cars is from the tire/ road interaction. Heavy trucks produce a high volume of noise from all three sources even at low speed (Chepesiuk, 2005).

Transport is a necessity, which is unavoidable. There may be few exceptional places on the globe, where transport noise may not be heard. An industrial society depends on mechanical transport for the efficient distribution of people and goods between dwelling, schools, shops, offices, factories leisure centres, and many other places. Nonetheless, it is major sources of noise created day in day out and poses a serious hazardous to man, material and animals (Mahandiyan, 2006). Traffic is considered to generate most annoying kind of node. Road traffic, rail traffic and air traffic, all contribute to transport noise (Bagad, 2009).

Of all the sources of noise pollution, road traffic is the most prevalent and perhaps the most damaging sources of noise pollution. More people are exposing to noise from motor vehicles than any other single source of noise pollution and thus the impacts are a major factor in human society. The impact of road traffic noise on the community depends on various factors such as road location and design, land use planning measures, building design, vehicles and driver behaviour. (Joshep 2005)

Increase in vehicular traffic is also a source of noise pollution around the globe especially in most urban cities around the world. The situation is getting seriously alarming with increase in traffic density on city roads. The emissions of smoke from cars are of great concern to the changes we are currently experiencing in the climate of this country and that of the world in general.

Due to traffic noise very high environmental noise levels due to traffic of vehicles were observed which is causing disturbance and even some health problems. Some suggestions such as planting trees on both sides of the road, banning hydraulic horns, improvement and streamlining of roads and parking system, discouragement of high sound producing vehicles, industries and public awareness would also be helpful in reduction of the present noise level in banepa. (Murthy et al., 2007)

Tandel B.N et al (2013) study was carried out to generate a noise prediction model and to analyze various parameters affecting road traffic noise the model, when validated given quite satisfactory results. This study revealed that presented noise level at all three major arterial roads exceed the limits prescribed by CPCB. Based on the finding, it can be said that the persons nearby these roads are exposed to significantly high noise levels and hence necessary mitigation measures should be adopted.

Air Craft Noise: Most of the impacts are perceived in the outdoor environment, since building structures are partially effective in shielding sound penetration to building interiors; however, important interior receptors affected by noise pollution include: factory worker exposure to industrial machinery; building interiors in the vicinity of major airports (generally within a five mile distance from flight paths); and occupants of multi-family dwellings where party walls or floor/ceiling assemblies are not effectively designed. A party wall is the wall separating two adjoining units in an apartment or condominium.

Now-a-days , the problem of low flying military aircraft has added a new dimension to community annoyance, as the nation seeks to improve its nap-of the- earth aircraft operations over national parks, wilderness areas , and other areas previously unaffected by aircraft noise has claimed national attention over recent years.

Major commercial airports promote the air transport industry and generate positive economic benefits to the airport and its host economy. However, external costs are associated with these benefits. Any increase in aircraft movements causes negative environmental impacts,

especially noise pollution. The effects of aircraft noise on the health and well being of the community must be understood before devising strategies and counter-measures. Aircraft noise potentially disturbs (or annoys) the daily activities (such as communication and relaxation) of residents living in the vicinity of airports. This particular type of annoyance undermines quality of life and can be a cause of stress. Evidence is emerging that appears to associate some forms of health risk with this stress (Journal of the Eastern Asia Society for Transportation Studies, 2005).

Aircraft noise is noise pollution produced by any aircraft or its components, during various phases of a flight: on the ground while parked such as auxiliary power units, while taxiing, on run-up from propeller and jet exhaust, during takeoff, underneath and lateral to departure and arrival paths, over-flying while en route, or during landing. (Encyclopaedia)

According to Agarwal the takeoff and landing of an aircraft produce noise. The higher is the speed of an aircraft the greater the noise pollution. It has become a problem now-days. It has increasing source of annoyance to the large number of the people who live in the vicinity of air ports. According to Rajgopalan noise from planes flying over residential areas impairs people's ability to work, learn in school and sleep, and consequently also results in lowered property values in affected areas. As passenger volume increases and new and larger airports are built, noise is becoming even more of a concern.

Noise nuisance from aircraft can be reduced significantly by changing the way the planes come in to land. Lining up with the runway as far as 70 kilometres away and making a steady descent can more than halve the acoustic energy that reaches the ground, an international research consortium has found (Marks, 2003). Noise pollution around airports is set to get worse. Air traffic worldwide is increasing at 4.7 per cent per year and is expected to triple by 2030. Without a major initiative to reduce aircraft noise, airports will be prevented from handling the extra flights, says Mike Hawse, director of technology and engineering at the British aero-engine maker Rolls-Royce.

Noise from railroads: Railway noise is largely a problem of freight trains and trains containing older wagons or engines, and is a particularly severe problem during the night. Rolling noise is generally higher from poorly maintained rail vehicles, and from trains running on poorly maintained infrastructure. Aerodynamic noise is particularly relevant for high speed lines where, in most cases, noise limiting measures like noise barriers are implemented; noise barriers reduce the impact of rolling noise, but are usually too low to have any effect on noise originating at the pantograph. Engine noise is most relevant at lower speeds up to about 30 km/h, rolling noise above 30 km/h and aerodynamic noise dominates above 200 km/h. The most important noise source is rolling noise, which affects all kinds of train (Heinrichmeyer et al, 2012).

The noise from locomotive engines, horns and whistles, and switching and shunting operation in rail yards can impact neighbouring communities and railroad workers. For example, rail car retarders can produce a high frequency, high level screech that can reach peak levels of 120 dB at a distance of 100 feet, which translates to levels as high as 138, or 140 dB at the railroad worker's ear. Sometimes residents are disturbed by noise originating from railways near their houses – either from the trains themselves or by works taking place on the tracks or railway premises. People living beside railway stations put up with a lot of noise from locomotive engines, horns and whistles and switching and shunting operation in rail yards. This is one of the major sources of noise pollution.

Near railway stations, the intensity of sound s much loud and become a physical irritant to leave its diverse consequences after long exposures. In fact, the sound waves travel into atmosphere and pollute the entire environment, and everyone feels uncomfortable in this environment. This noise level of train is more than 150dB (Gupta, 2006).

Construction Noise: According to Occupational Safety and Health Administration Construction sites have many noisy operations and can be a significant source of noise exposure. Exposure to high levels of noise can

cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss.

The noise from the construction of highways, city streets, and buildings is a major contributor to the urban scene. Construction noise sources include pneumatic hammers, air compressors, bulldozers, loaders, dump trucks (and their back-up signals), and pavement breakers. Many construction jobs, such as concrete work, site excavation, highway construction, and carpentry, involve high levels of noise. Major noise sources include heavy equipment, such as loaders, and cranes, as well as tools like jackhammers and chipping guns.

Excessive noise at construction site not only causes hearing loss, but also can create safety hazard by masking the sound of oncoming vehicles. Hearing loss and the use of hearing protectors by those with pre-existing hearing loss may further interfere with the workers' ability to hear and perceive the sound of danger. Although these difficulties occur in many occupational settings, they are a particular problem in construction, where variety of moving vehicles, back-up alarms, and other signals and activities may occur simultaneously (Moran, 2003).

The loss of hearing by employees within the construction industry is significant. Over an extended period of time exposure to loud sounds that are produced on the construction site can cause hearing damage. It has been a belief within the construction industry, that construction worker, who is employed for long periods of time, over ten years, will have hearing loss. The loss of hearing is an enormous problem that many continue to ignore. "Despite the fact that it is 100 percent preventable, loss of hearing is one of the most prevalent occupational diseases. Hearing loss of workers can have a drastic negative effect on their lives. Although this problem has been known for a long time there is little knowledge or researches about construction noise that would help to understand the sounds that cause this prevalent damage (Callahan, 2004).

The noise levels created by construction equipment will vary depending on factors such as the type of equipment, the specific model, the

operation being performed, and condition of the equipment. The equivalent sound of the construction activity also depends on the fraction of the time that the equipment is operated over the time period of construction.

Construction workers are among the most affected by industrial deafness. The 1998 International Labour Office encyclopaedia lists the construction industry as the fourth noisiest industry sector. It is very important for the construction industry to adopt a preventive management program aimed at the reduction of workers noise exposures. The best ways to achieve this reduction are to employ quiet work practices (like quiet piling systems) and use quiet construction equipment (like silenced compressors). When quieter alternatives are not available, consideration should be given to a site layout to arrange noisy processes away from workers not involved in their operation. Portable barriers can be used around static equipment like generators and concrete pumps (www.workcover.nsw.gov.au).

Noise from Consumer products: Noise from consumer products and other hazardous sounds can be generated by a variety of sources, including kitchen appliances, audio system, power tools both hand held and stationery, and all types of yard equipments. High levels of noise from these products and long exposures times can contribute to the risk of Noise induced hearing loss from occupational noise. It is reasonable to assume that 3dB exchange rate applies to exposures longer than 8 hours, from either or both. Noise levels from a variety of consumer products, including toys (Schwela, 2006). Some consumer products make noise loud enough to damage your hearing.

Personal stereo systems (like iPods® and MP3 players) with headphones or earphones can be dangerous if played too loudly. Some toys and tools also make very loud noises. (http://healthycanadians.gc.ca). Certain household equipment, such as vacuum cleaners and some kitchen appliances have been and continue to be noisemakers, although their contribution to the daily noise dose is usually not very large.

Recreational noise and noise from personal listening devices: Sources of hazardous recreational noise include on-road and off road vehicles, loud music concerts, and small aircrafts engines. Like exposure to noise from

consumer products, the degree of risk depends on the pressure level and exposure time, as well as the amount of noise exposure in the workplace.

Personal listening devices are known to emit sound pressure levels that can be hazardous, if they are abused. It has been estimated that at least 5 percent of users of these devices are exposed than 8dB (Fligor 2008) considering the very large number of such devices sold, and the frequent long exposure times, it has been estimated that 50, 0000 people develops NHIL from listening to such devices for more than 4 hours per day over a period of years (Fligor 2009: SCENIHR 2008).

Loudspeakers: Loudspeakers are widely used in cities and smaller towns and have become part and parcel of our life in the present day. They can be heard blaring away at social functions like birthday parties, marriages ceremonies or political parties or meetings. The larger the gathering, the louder is the music and the festive. But the ban of its use after 10pm is blessing for most of the citizens (Pillai, 2006).

According to Kochhar, Seethapalli Loudspeakers used in meetings and functions are also sources of noise. Loud music played in buses, restaurants and shops and houses also create sources of nose pollution. Loudspeakers contribute a lot of noise especially during festivals which often occur at night (Naseem, 2011). According to Dr. Bhargava In India no functions or ceremony is complete without a loud speaker, which has all the characteristics of creating public nuisance. The 'Jagrans', 'Jagratas', 'Ramlilas' and completion of these religious ceremonies in the temple or private go for whole night marks the use of loudspeakers. The stipulation of point noise standard for loudspeakers will enable their regulation under the environmental laws. Presently, the use of loudspeakers is regulated under laws pertaining to public nuisance or which relate to maintenance of law and order (Shrivastava, 2007).

C. Harmful effects of noise pollution

Noise pollution affects human begins at three levels: auditory effect, non auditory and physiological effect. High intensity noise cause

annoyance and hearing impermanent, stimulation of reception in skin and pain, nausea and vomiting, dizziness and insanity, ear drum rupture anal lung damage. The mechanism of hearing loss result from short intense exposure which damage organ of cortex (Aggrwal, 2009).

Sleep disturbance: Exposure to noise can induce disturbance in sleep by causing difficulties in falling asleep, alterations in sleep rhythm or depth of sleep, and also through being woken up (Babisch, 2007). Long-term effects of noise- induced sleep interruption could be subjective fatigue, changes in performance and objective mood changes. Noise pollution above 45 decibels wakes up most people, while light sleepers could be affected by noises at lower decibel levels. A loss of sleep can lead to a wide range of health conditions; including exhaustion, irritability, and loss of focus or even a weakened immune system (http://www.symptomfind.com/).

Uninterrupted sleep is known to be a prerequisite for good physiological and mental functioning in healthy individuals. There is both objective and subjective evidence for sleep disturbance by noise. Exposure to noise disturbs sleep proportional to the amount of noise experienced in terms of an increased rate of changes in sleep stages and in number of awakenings. Objective sleep disturbance is likely to occur if there are more noise events in the night with a maximum level of 50 dB indoors or more. When sleep disruption becomes chronic; the results are mood changes, slowness in task performance, and other long-term effects on health and well being. Noise exposure during sleep may increase blood pressure, heart rate and finger pulse amplitude as well as uncontrollable body movements.

Other primary sleep disturbances are difficulty in falling asleep, frequent awakenings, waking too early, and alternations in sleep stages and depth. It thus seems that, although there may be some adaptations to sleep disturbance by noise, complete habituation does not occur, particularly for heart rate. Although the long term health consequences of noise are inconclusive, noise induced sleep loss has been found to impair task performance the next day (Noise and Health Environment: Health Perspective, 2005).

Noise pollution is a major cause of sleep disturbance. Apart from various effects on sleep itself, noise pollution during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, cardiac arrhythmias, and increased body movement. These effects do not decrease over time. Secondary effects include fatigue, depressed mood and well-being, and decreased performance. Combinations of noise and vibration have a significant detrimental effect on health, even at low sound pressure levels.

According to Isabelle Lane adequate well rested sleep is essential to maintain good health and mental function. Noise is a common identified offender of interrupting sleep and it causes both primary and secondary sleep disturbances. The primary effects include difficulty falling asleep, differences of sleep patterns, and awakenings. Secondary effects describe the consequences of interrupted sleep including fatigue, decreased well-being and performance. In addition to these primary and secondary effects, environmental noise exposure during sleep is accompanied by several physiological effects.

Annoyance: Exposure to environmental noise may interfere with ongoing activities and can be experienced as bothersome or annoying. Annoyance is generally defined as a feeling of displeasure concerning a source of pollution in the environment, which the individual knows or believes, will adversely affect his or her well being (Manuel, 2005). The extent of annoyance is closely related to the noise levels from heavy vehicles. The noise from heavy vehicles is clearly distinguishable from a background of lower levels produced by passenger cars (Hart, 1997).

Annoying is a feeling of discomfort which occurs when noise interferes with someone's thoughts, feelings or daily activities. This annoying can be due to sounds with high Sound Pressure Level or exposing to noise for long time even with low Sound Pressure Level. The degree of annoyance depends on the intensity and/or the frequency of the noise and its variation with time. The age of people supposed to such high level noise can play a major role in the results. In general, children are expected to be more

sensitive to such effect. Their ability of learning languages, concentration, memory reduction and ability to carry out their tasks can be easily affected (Louise, 2002). For that reason, children have been chosen as the focal point of some research groups (Abdel-Raziq I. R. et.al. 2000 and Bisturp M. L. et.al. 2002). However the effect of noise might be temporary after which the person returns to its normal condition. There are obvious evidences that variation of blood pressure levels at early ages can be considered as good indicators for blood pressure levels at later ages (Wolfgang, 2008).

According to World Health Organization Guideline for Community Noise annoyance is defined as a feeling of displeasure associated with any agent or condition believed by an individual to adversely affect him or her. Annoyance increases significantly when noise is accompanied by vibration or by low frequency components. The term annoyance does not begin to cover the wide range of negative reactions associated with noise pollution; these include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction agitation, or exhaustion. Social and behavioural effects are complex, subtle, and indirect. These effects include changes in everyday behaviour (closing windows and doors to eliminate outside noises), changes in social behaviour (aggressiveness or disengagement), and changes in social indicators (residential mobility, hospital admissions, drug consumption, and accident rates), and changes in mood (increased reports of depression). Noise above 80 dB is consistently associated with decreased helping behaviour and increased aggressiveness.

Hearing loss: According to Albany 2010 auditory Health Effects noise-induced hearing loss usually occurs over a lengthy period. By the time it is evident, it may be too late. Early warning signs include a ringing or buzzing in the ear (tinnitus) and muffled hearing. Noise is one of the main causes of the hearing loss suffered by people.

Tinnitus is caused by damage of the hair cells in the inner ear after noise damage. Acoustic Trauma is caused by a short blast of loud noise that can induce short-term hearing loss and or which ringing in the ears. Temporary Threshold Shift (TTS) is temporary hearing loss that a person

suffers after exposure to loud noise. After a few hours in a quiet place, hearing will return. Permanent Threshold Shift (PTS) is permanent hearing loss that develops after months or years of continual noise damage. The damage builds up until it affects the everyday life of the individual. It does not go away after spending time in a quiet place; it is irreversible.

Non-Auditory Health Effects noise puts stress and tension on the body. The non-auditory health effects of noise include muscle reactions, heart palpitations, dilation of pupils, secretion of adrenalin and thyroid hormones, constriction of blood vessels, and movements of stomach and intestines. Studies show that boom car noise can cause kidney and heart failure.

In addition, noise damages mental health. Noise can make people anxious, angry, dissatisfied, and exhausted. Studies show that noise increases aggressive behaviour and worsens depression. Noise is a major reason for sleep loss, which can lead to chronic fatigue. Intermittent noise is more disruptive to sleep loss than continual noise. The Environmental Protection Agency states that a 35 dB sound level allows healthy sleep.

Noise in the workplace can damage hearing. Hearing damage may occur when noise is higher than 85 decibels, which is about the loudness of heavy traffic. Damage can include tinnitus, hearing loss and other health problems such as headaches and fatigue (http://www.betterhealth.vic.gov.au).

Cardiovascular effects: There is now a growing body of evidence associating noise pollution with cardiovascular disease. These effects are secondary to the body's "fight or flight" response leading to autonomic nervous and endocrine effects seen with chronic daily levels of noise greater than 65 dB or acute exposure to levels above 80 to 85 dB. These effects lead to elevated blood pressure, heart rate, and peripheral resistance by the release of hormones such as norepinehrine, epinephrine, and cortisol.

A study by Rosenlund et al, have demonstrated an increase prevalence of high blood pressure with people exposed to aircraft noise. The subjects in this study were between the ages of 18 and 80 and effects were greatest among the elderly. Another study by Jarup et al also revealed a

relationship of daily traffic noise and night time aircraft noise and an increase in blood pressure. This study included participants between the ages of 45-75 years living near one of six major airports for a minimum of 5 years. Cardiovascular effects of noise pollution are not unique to adults. Unfortunately, there is evidence that young children are also at risk. In one study performed in 1995, blood pressure and heart rate was measured in 1,542 children between the ages of 3-7 years old who attended kindergartens in areas with traffic noise was greater than 60 dB. The results showed that the preschool children had a higher mean systolic and diastolic blood pressure and lower heart rate than those children in quite areas. Additionally, these children had higher blood pressure readings above the 95th percentile.

Cardiovascular Disease: In adults, both short-term and long-term adverse health effects have been documented including increased blood pressure, increased heart rate, vasoconstriction, elevated stress hormones such as epinephrine and cortisol, arrhythmias, ischemic heart disease, and strokes. In children, increased stress-related hormones and elevated blood pressures have especially been seen in children with lower academic achievement (http://www.coaltrainfacts.org).

A growing body of evidence confirms that noise pollution has both temporary and permanent effects on humans by way of the endocrine and autonomic nervous systems. It has been postulated that noise acts as a nonspecific biologic stressor eliciting reactions that prepare the body for a fight or flight response. For this reason, noise can trigger both endocrine and autonomic nervous system responses that affect the cardiovascular system and thus may be a risk factor for cardiovascular disease. These effects begin to be seen with long-term daily exposure to noise levels above 65 dB or with acute exposure to noise levels above 80 to 85 dB. Acute exposure to noise activates nervous and hormonal responses, leading to temporary increases in blood pressure, heart rate, and vasoconstriction. Studies of individuals exposed to occupational or environmental noise show that exposure of sufficient intensity and duration increases heart rate and peripheral resistance, increases blood pressure, increases blood viscosity and levels of blood lipids, causes shifts in electrolytes, and increases levels of epinephrine,

norepinephrine, and cortisol. Sudden unexpected noise evokes reflex responses as well. Cardiovascular disturbances are independent of sleep disturbances; noise that does not interfere with the sleep of subjects may still provoke autonomic responses and secretion of epinephrine, norepinephrine, and cortisol. These responses suggest that one can never completely get used to night-time noise (Goines et al, 2007).

Temporary noise exposure produces readily reversible physiologic changes. However, noise exposure of sufficient intensity, duration, and unpredictability provokes changes that may not be so readily reversible. The studies that have been done on the effects of environmental noise have shown an association between noise exposure and subsequent cardiovascular disease. Even though the increased risk for noise-induced cardiovascular disease may be small, it assumes public health importance because both the number of people at risk and the noise to which they are exposed continue to increase.

Physical effects of noise: Noise of a high enough intensity will cause temporary or permanent damage to hearing. The mechanism behind these injuries is well understood. High levels of noise giving rise to noise induced hearing deficits can be experienced in various situations example in occupational situations, at motor sports events, at shooting ranges from loudspeakers or headphones within dwelling (Schwela and Zali, 1999) on account of single variation in human sensitivity to noisy environments and to the likelihood that they would cause hearing impairment, the hazardous nature of a noisy environment is described in terms of " damage risk"(Schwela and Zali, 1999).

Physiological effects: Noise can cause temporary stress reaction (e.g. increasing the heart beat and also blood pressure), and produce negative effects on the digestive and respiratory system based on observation of an increase in blood pressure after acute exposure to noise, it has been suggested that long-term exposure to noise could cause persistent increase in blood pressure (Schwela and Zali, 1999). This hypothesis can be evaluated by examining experiences from epidemiological studies.

A review of the cardiovascular effects of noise reports that 55 studies have been performed on the relationship between noise and blood pressure and that 80% of these reported some form of positive association (Tripathi, 1994).

A few studies have also been made in the general population, comparing the physiological reaction of those living noisy streets with those of people living along quiet streets. The result from some early studies shows slightly higher blood pressure levels among people living along roads with heavy traffic as opposed to those living areas (Kryler, 1994).

D. Prevention of noise pollution

Noise pollution has harmful effects on both our body and mind. The safe intensity level of sound, as prescribed by World Health Organization (WHO) is 45 dB. But in the present era, it is rarely maintained and the result is 'Noise Pollution'. It can be mentioned that two very simple measures can help a lot in abating noise pollution. The cities can be developed in a planned manner. Industry and transport areas can be separated into zones, residential areas may be made at least 20 meters away from the main streets and the space be thickly planted. Heavy vehicles should not be allowed to use narrow streets and the use of horns and pressure horns is prohibited (http://www.publishyourarticles.net).

Personal hearing protection: According to Safeguard Noise Control in the Workplace personal hearing protection such as earmuffs or earplugs. Employees must be trained in fitting and wearing earmuffs and earplugs. Hearing protection must be worn for the entire duration of a noisy shift. Wearing hearing protection for only part of the shift is not sufficient. Routine maintenance and replacement procedures are also needed for the personal hearing protection equipment. Personal hearing protection equipment must be of an approved type.

Materials: Acoustical wall and ceiling panels can be constructed of many different materials and finishes. The ideal acoustical panels are those without a face or finish material that interferes with the acoustical infill or substrate.

Fabric covered panels are one way to maximize the acoustical absorption. The finish material is used to cover over the acoustical substrate. Mineral fiber board, or Micore, is a commonly used acoustical substrate. Finish materials often consist of fabric, wood or metal. Fabric can be wrapped around substrates to create what is referred to as a "pre-fabricated panel" if laid onto a wall, and require no modifications. Such fabrics are generally acoustically 'transparent, meaning that they do not impede a sound wave. Prefabricated panels are limited to the size of the subas "on-site acoustical wall panels" This is constructed by "framing" the perimeter track into shape, infilling the acoustical substrate and then stretching and tucking the fabric into the perimeter frame system. On-site wall panels can be constructed to work around door frames, baseboard, or any other intrusion. Large panels (generally greater than 50 feet) can be created on walls and ceilings with this method. Double-glazed and thicker windows can also prevent sound transmission from the outdoors (http://en.wikipedia.org).

Urban planning: Communities may use zoning codes to isolate noisy urban activities from areas that should be protected from such unhealthy exposures and to establish noise standards in areas that may not be conducive to such isolation strategies. Mixed use areas present especially difficult conflicts that require special attention to the need to protect people from the harmful effects of noise pollution. Noise is generally one consideration in an environmental impact statement, if applicable (such as transportation system construction). (Benz Kotzen, noise is an urban issue). One of the best ways of reducing noise pollution is through making green belt around the residential areas, around airport and on the sides of the road where the vehicles and trains run.

Control of Noise pollution

- Control of Noise pollution at Source
- Noise producing industries, railway stations, aerodrome, etc. should be located far away from the residential areas.
- We should play various music systems such as stereos, television, etc. at low volume.

- We should not use loud speakers during night. Even during time they should be used at low volumes.
- Various machines should be well maintained so that they produce less sound.
- It is observed that certain persons blow horns of their vehicles unnecessarily, or remove silencers of the exhaust pipes of vehicles. Such practices produce lot of noise and should be avoided.
- Laws should be framed so that the persons producing unnecessary noise are punished.

Control of Noise Pollution by obstructing the path of Noise

- By constructing soundproof buildings, the menace of sound pollution can be minimized. Construction of soundproof rooms for noisy machines in industrial and manufacturing installations must be encouraged. This is also important for residential building—noisy machines should be installed far from sleeping and living rooms, like in a basement or garage.
- Plants also help in controlling noise pollution because they absorb high frequency sound waves. Thus, planting trees along the roads help in controlling noise pollution.

E. Laws in India for Reducing noise pollution

According to State Pollution Control Boards

Steps taken to control vehicular pollution

- Emission Standards for Tractors : Emission norms for tractors were notified on 8.9.1999 under the Central Motor Vehicle Rules is effective from 1.10.1999.
- India 2000 Emission Norms akin to Euro-I Norms: Emission norms known as India 2000 akin to Euro I norms was notified on 28.8.1997 under the Central Motor Vehicle Rules is effective from 1.4.2000 for the entire country, required major modifications in the engine designs.

- Establishment of Ambient Air Quality Monitoring throughout India
- Notification of Ambient Air Quality Standards under Environment (Protection) Act.
- Notification of vehicular emission norms for year 1990-91,1996, 1998, 2000, 2001
- Improving fuel quality by phasing out lead from gasoline, reducing diesel sulphur, reducing gasoline benzene, and etc.
- Introduction of alternate fuelled vehicles like CNG/LPG.
- Improvement of public transport system.
- Phasing out of grossly polluting commercial vehicles.
- Public awareness & campaigns.

The measures for control of noise pollution

- Ambient standards in respect of noise for different categories of areas (residential, commercial, industrial) and silence zones have been notified under the Environment (Protection) Act, 1986. Noise limits have been prescribed for automobiles, domestic appliances and construction equipment at the manufacturing stage. Standards have been evolved and notified for the gen sets, fire crackers and coal mines. Regulatory agencies have been directed to enforce the standards for control and regulate noise pollution.

Steps taken to control noise pollution due to fire crackers

- The Govt. of India has enacted noise standards for fire-crackers vide G.S.R.682(E), dated 5th October, 1999, in an effort to control noise pollution due to fire crackers Recently in March 2001, Central Pollution Control Board in association with National Physical Laboratory (NPL), Delhi initiated a study on measurement of noise levels of fire-crackers available in the market. The study indicates that 95% of the fire-crackers samples exceed the prescribed noise limits. Consequently, CPCB issued notice under Section 5, of the Environment (Protection) Act, 1986 to the Department of Explosives, Nagpur, to take immediate steps to control manufacturing of fire-crackers exceeding the

prescribed limits. All the State Pollution Control Boards/Committees were also requested to initiate steps to control sale of fire-crackers exceeding the notified limits, in consultation with their respective local administrations.

Steps taken to control noise pollution due to loud-speakers

- The Govt. of India has enacted Noise Pollution (Regulation and Control) Rules, 2000 vide S.O.123(E), dated 14th February, 2000. The Rule deals with provisions to control noise pollution due to loud-speakers and public address system, as given below : Restriction on the use of loud speakers/utility address system :
- A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.
- A loud speaker or a public address system shall not be used at night (between 10.00 p.m. to 6.00 p.m.) except in closed premises for communication within e.g. auditoria, conference rooms, community halls and banquet halls.

Steps taken to control noise pollution from generator sets

- The Central Pollution Control Board, in association with the Indian Institute of Science, Bangalore, had developed systems for control of noise pollution from diesel generator sets as well as from petrol/kerosene generator sets. Based on this, the noise standards for diesel and petrol/kerosene generator sets have been developed and notified.

Steps taken to control noise pollution in the country

- Ambient noise standards were notified in 1989, which formed the basis for State Pollution Control Boards to initiate action against violating sources.
- The vehicular noise standards, notified in 1990, are being implemented by Ministry of Science and Technology, to reduce traffic noise. These standards have been made more stringent vide a notification in

September 2000 and will be effective from January, 2003.

- Noise standards for diesel genset were prescribed in Dec. 1998. Govt. has been pursuing with State Pollution Control Boards, generator manufacturing and major users, for implementation of these standards. Presently these standards are being revised (the MoEF is in the process of issuing notification) making it mandatory for all generator manufacturers to provide acoustic enclosure at the manufacturing stage itself. This will have a major impact on noise from DG sets.
- Noise standards for fire-crackers were developed in October, 1999. Central Pollution Control Board had carried out a compliance testing of the fire crackers available in the market and also taken up with the Department of Explosives for compliance with these standards.
- Noise standards for petrol and kerosene generator sets were notified in September, 2000, and will be effective from September, 2002. The sale of these gensets will be prohibited if not certified by the testing agencies, identified for the purpose.
- The Noise Rules, 2000, regulates noise due to Public Address System/ Loud speakers and also prescribed procedures for noise complaint handling.
- Central Pollution Control Board has taken up a study on aircraft noise monitoring in Indira Gandhi International Airport, Delhi. This will be followed by development of guidelines/ standards for aircraft noise.

Functions of Central Pollution Control Board :

- Advise the Central Government on matters relating to pollution;
- Coordinate the activities of the State Boards;
- Provide Technical assistance to the State Boards, carry out and sponsor investigations and research relating to control of pollution;
- Plan and organize training of personnel;
- Collect, compile and publish technical and statistical data, prepare manuals and code of conduct.
- To lay down standards;

- To plan nationwide programme for pollution control.

Functions of the State Pollution Control Boards:

- To advise the State Government on matter relating to pollution and on sitting of industries
- To plan programme for pollution control;
- To collect and disseminate information;
- To carry our inspection;
- To lay down effluent and emission standards;
- To issue consent to industries and other activities for compliance of prescribed emission and effluent standards.

III. METHODOLOGY

The methodology on “Computing the noise level in commercial areas” consists of two phases:

A. Survey of visitors in commercial areas
B. Computing noise level in the selected commercial areas

A. Survey of visitors in commercial areas

Surveys are one of the most important basic research methods in the social science and an important tool in applied work (Marsden, and Wright, 2010). A survey is a systematic method for gathering information from (a sample of) entities for the purposes of constructing quantitative description of attributes of the larger population of which the entities are members (Groves, Fowler, Couper, Lepkowski, Singer, and Tourangeau 2009). Hence survey was carried out to gather information on the effects of noise pollution in the community which consisted of the following headings.

1. Selection of commercial area
2. Selection of sample
3. Selection of method
4. Formulation of tool
5. Conduct of the study
6. Consolidation and analysis of data.

1. Selection of commercial area

Two malls Brook Fields Mall and Fun Republic Mall were selected for the study which is shown in Plate2.

a. Brook Fields Mall

b. Fun Republic Mall

Plate 1

2. Selection of sample

According to World Health Organization sampling is a process of choosing a section of the population for observation and study. Purposive sampling sample is one where people from apre-specified group are sought out and sampled (Gerrish, 2013). With purposive sampling the sample is ‘handpicked’ for the research. The term applied to those situations where the researchers already knows some-thing about the specific people or

events and deliberately selects particular ones because they are seen as instance that are likely to produce most value able data (Denscombe, 2007).

One hundred visitors 50 each from mall were chosen using purposive sampling method. Brookefields, was a shopping mall located on Brookebond Road (Krishnasamy Road) in Coimbatore. It was opened in late 2008. The mall had outlets from major clothing and apparel brands and a six screen multiplex cinema, along with a food court serving multi-cuisine dishes. Fun Republic Mall was a shopping mall in Peelamedu, Coimbatore, India. The mall was located on the arterial Avinashi Road on a 3.5 acres site. The mall had 6 levels with a total area of 5.25 lakh sq.ft. The mall had Shoppers Stop as its anchor store spread over 79,000sq.ft. The mall had a five screen multiplex operated by Fun Cinemas with a capacity of 1,119 seats. The mall had McDonalds restaurant spread over 3,470 sq.ft in two floors in addition to its food court.

3. Selection of method

An interview method was selected. Interview is a conversation between two or more people where questions are asked by the interviewer to elicit facts or statements from the interviewee. An interview is a conversation, usually between two people. But the conversation where one person-the interviewer is seeking responses for a particular purpose from other person: the interviewee. The most structured form of interview (common in market research) are those where the interviewer knows what he or she wants to find out and the interviewee just has to answer the direct question (Gillham, 2005).

4. Selection of tool

Interview schedule was selected to collect information. An Interview schedule is a formal list used in interviews to aid, in the systematic collection of data through questions. The content, wording and sequence of an Interview schedule are pre fixed in advance and serve as a guide for gathering info pertinent to the research. (Taylor et al, 2006).

After designing the survey materials, it is vital to pre-test the schedule and the survey processes among small group sample in an area similar to that in which real survey will be done. Hence a pilot study was conducted. Pre-testing will help to identify the problems (Kumar, 2002). The aim of pilot study is to try out the research approach to identify potential problems that may affect the quality and validity of the results (Blessing and Chakrabarti, 2009). Based on the results of the pilot schedule was modified and finalised (Appendix I)

5. Conduct of the study

Only on the establishment of proper rapport the observer will become acceptable to the group and gain their confidence at the same time he should impress upon the group particularly his informants, about the confidentiality of their identification in the study. Only then the members of the group become less formal, less restrained, relaxed and will be ready to actively participate and help the observer in his research effort. After the establishment of proper rapport and climate for study, the researcher should proceed for full observation and recording. Observation normally does not pose a problem once rapport has been established (Sharma, 2007). After the establishment of good rapport with participants, the required informations were collected using the tool.

6. Consolidation and analysis of data.

Data consolidation refers to the collection and integration of data from multiple sources into a single destination. During this process, different data sources are put together, or consolidated, into a single data store (http://www.techopedia.com). Analysis of data is a process of inspecting, cleaning, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision making. Data collection is for record keeping (Hellerstein, 2007). Hence collected data were consolidated, tabulated, analysed and are presented under Result and Discussion

B. Computing noise level in selected commercial areas.

An experiment refers to an investigation in which a factor or variable under test are isolated and effects are measured. In an experiment the investigator measures the effect of an experiment, which conducts intentionally as remarked (Kothari, 2004).

The field experiment was conducted the experiment with following steps:

1. Selection of instrument for measuring noise level in commercial areas
2. Selection of area for measuring the noise level
3. Assessment of the noise level in selected locations

1. Selection of instrument for measuring noise level in commercial areas

A sound level meter or sound meter which is an instrument that measures sound pressure level, commonly used in noise pollution studies for the quantification of different kinds of noise, was selected to measure the noise level (Plate 2).

Since sound level meter provides a measure of sound intensity at only one point in time, it is generally necessary to take a number of measurements at different times to estimate noise level (Berger, 2003).

Plate 2

Sound level meter

Model used for measuring sound level was CITEZEN model CT-500 which is dual powered (high power solar+ back up battery) calculator operative under any working condition. The calculator switches the power off automatically if there has been no key entry for about 5 minutes.

2. **Selection of area for measuring the noise level (Plate 3)**

The locations selected to record noise level were:

- Entrance: Place of entrance from where people enter the mall, at entrance noise of traffic and vehicles were there. Security guards checking the people while entering the mall, conversations between them also produce the noise.

- Food court: The common places where people sit under one roof and enjoy their meals. When group of people sit together they talk, they share and laugh this also creates noise for others. Long queues for the food and billing procure also leads to noise.

- Lifts, escalators and stairs: The passage through which people move from one floor to other. In lifts, speakers are there for announcements about the floor number when it is loud it creates noise also when there are more number of peoples. Most of the people use escalators for moving from one floor to other, bunch of people using escalators create noise.

- Corridors: corridor is the place where many people will be there at a same time they can create noise by talking, by walking and clapping of audience while watching the events.

3. **Assessment of the noise level in selected locations**

The noise level was measured using sound level meter. Three consecutive readings were taken in each location during weekday and weekends in day time and night and average was calculated.

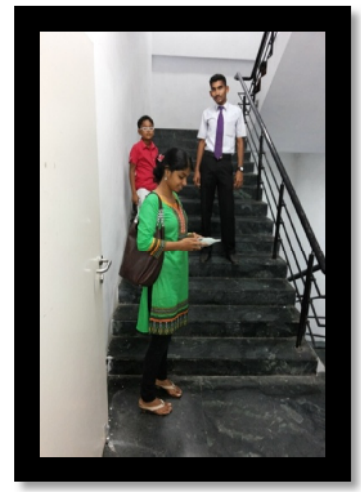
a. Food court

b. Corridors

c. Lift

d. Entrance

e. Escalator



f. Staircase

Plate 3

Locations for measuring noise level

IV. RESULT AND DISCUSSION

The findings of the study on “computing the noise level in commercial areas” are discussed under the following headings.

A. Findings of the market survey
B. Noise levels in commercial areas

A. Findings of the market survey

The findings of the market survey are discussed under the following aspects:

- Background information
- Awareness on noise pollution
- Tolerance limit
- Sources of noise pollution in mall
- Day of experiencing noise pollution
- Frequency of visit to commercial area
- Reasons for visiting the mall
- Installation of sound proof material
- Problems due to noise pollution
- Age group responsible for noise pollution
- Age group most affected by noise pollution
- Awareness on rules and regulation to prevent noise
- Suggestion to reduce noise pollution

1. **Background information**

In Background information the age group of surveyed people and sex of surveyed people is showed. Background information of surveyed people is depicted in Table I.

TABLE I

BACKGROUND INFORMATION

Criteria	**Percentage of Sample** **N=100**
Sex	
Male	40
Female	60
Age	
20-40	70
40-60	30

Hundred participants were surveyed in which 60 per cent were female and remaining 40 per cent were male. Thirty per cent were under the age group of 20-40 including both female and male and remaining 70 per cent were under the age group of 40-60 both female and male.

2. **Awareness on noise pollution**

Through the study it was revealed that all the participants were aware of noise pollution.

3. **Tolerance limit**

Table II and Figure 1 depict the percentage of people who expressed the tolerance limit of noise.

TABLE II

TOLERANCE LIMIT

dB	Percentage of sample N=100	
	Safe	Harmful
60-85	55	0
85-100	35	2
100-120	0	90

From the above Table it is clear that Fifty five per cent of people said that 60-85 dB is safe for human ears, thirty five percent of people said that 85-100 dB is safe. Ninety percent of people said that 100-120dB is harmful for ears.

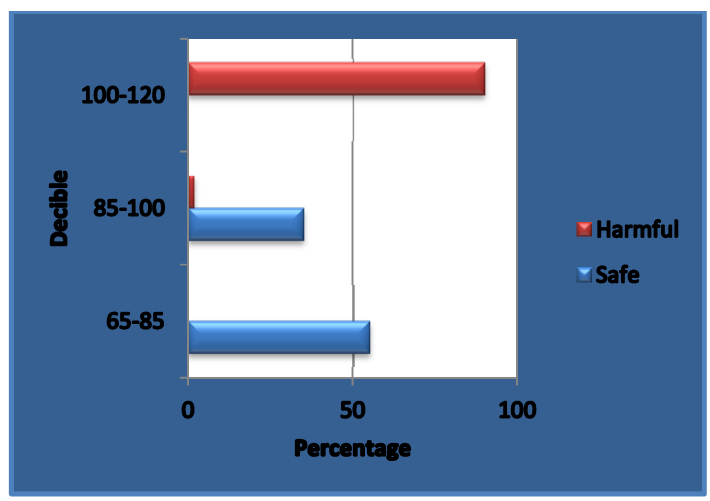


Figure 1

Tolerance limit

4. **Sources of noise pollution**

There were several sources of noise in commercial space that leads to noise pollution in commercial space as depicted in Table III and Figure 2.

TABLE III

SOURCES OF NOISE POLLUTION

Sources	Percentage of sample N=100
Vehicles	99
Events (dancing, singing etc)	50
Cinemas	45
People (there conversation, purchasing, moving from one place to other etc)	30
Others (fires works, loud speakers etc)	20
Gaming zone	15

It is clear from the above Table that there were several sources of noise in commercial space such as vehicles, people talking with each other, costumers making purchasing and visitors moving from one place to other. These days' commercial places are conducting events and shows such as singing and dancing competition which are also responsible for noise pollution. Commercial places had lots of entertainment sources such as games and movies which also led to noise.

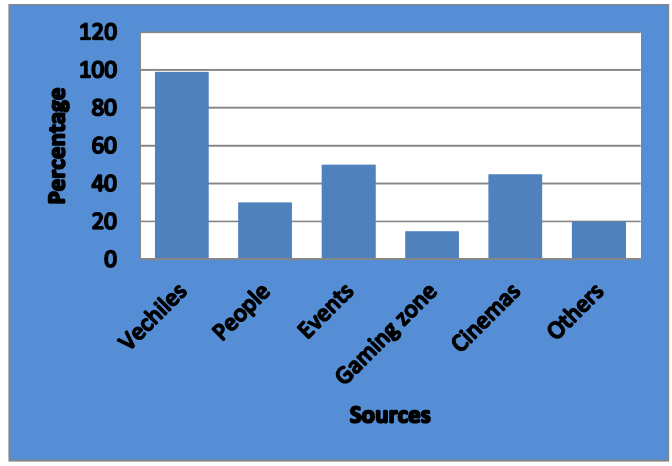


Figure 2

Sources of noise pollution

5. **Day of experiencing noise pollution**

Different people experience noise during different days as they visit on different days of the week some may visit in weekdays and some visit in weekends. Day of experiencing noise pollution by participants is depicted in Table IV and Figure 3

TABLE IV

DAY OF EXPERIENCING NOISE POLLUTION

Day	**Percentage of sample** **N=100**
Weekends	65
Weekdays	35

Different people experienced noise during different days, 65 per cent of people said that they experienced noise mostly in weekends and remaining 35 per cent of participants experienced noise even in weekdays.

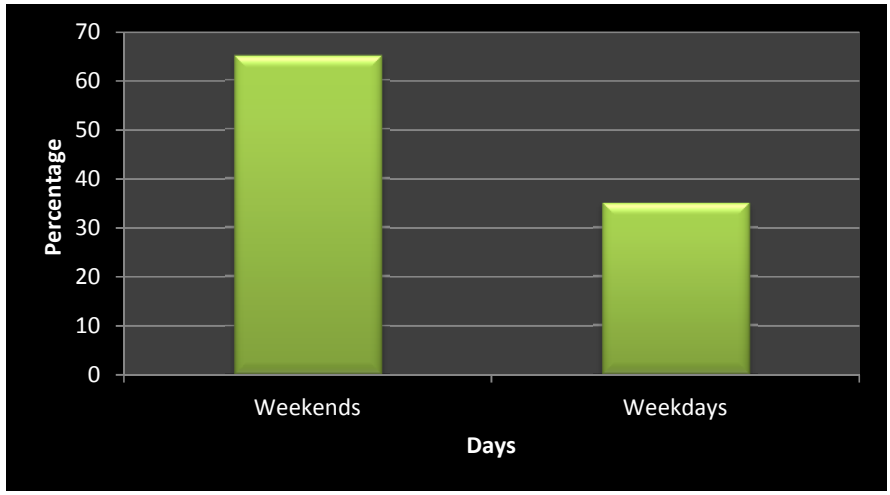


Figure 3

Day of experiencing noise pollution

6. **Frequency of visiting to mall**

People visited commercial place for different purposes some people visited for shopping some for entertainment hence there visiting days also varied. Frequency of visit of participants to commercial area is depicted in Table V and Figure 4.

TABLE V

FREQUENCY OF VISITING TO MALL

Visiting frequency	Percentage of sample N=100
Only Weekends	73
More than twice in a week	12
Weekly once	10

It is clear from the above Table that a majority of 73 per cent people prefer to visit in weekends and remaining 27 per cent people prefer to visit in weekdays among which ten percent visit weekly once and twelve percent more than twice in a week.

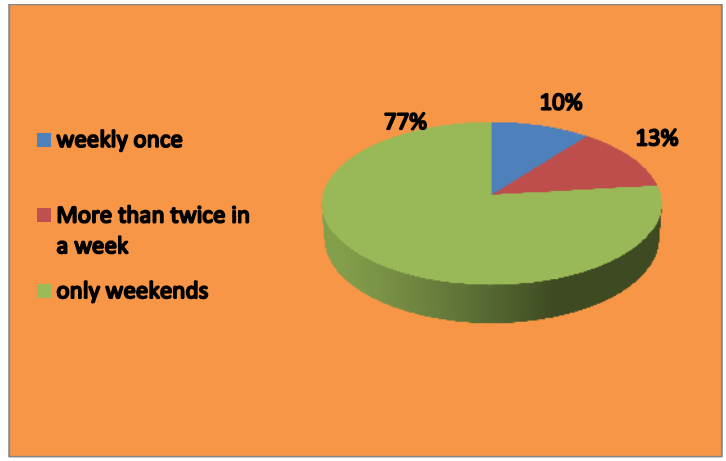


Figure 4

Frequency of visiting to mall

7. **Reasons for visiting the mall**

People visited mall for different purposes, the reasons for visiting the mall is shown in Table VI and Figure 5.

TABLE VI

REASONS FOR VISITING THE MALL

Reason	Percentage of sample N=100
Shopping	45
Get together	20
Entertainment	15
Eating	10
Movie	7
Meetings	3

It is clear from the above Table that the people visited to mall for different purposes. Majority of 45 per cent of people came to mall for doing shopping and 20 per cent of people liked to come for get together. There were people who preferred to come for eating, movie and entertainment purpose. Only few people came for attending meeting.

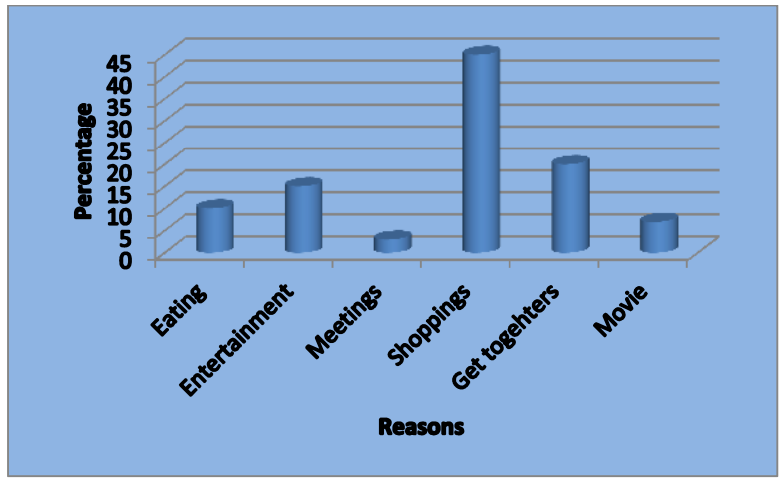


Figure 5

Reason for visiting the mall

8. **Installation of sound proof material**

Now a day's installation of sound proof material is very common which are preferred by most of the interior designers and architects as they control the noise. It was noted by investigator that majority of the participants did not install any kind of sound proof material to their living place, 75 per cent of people did not install sound proof material remaining only 25 per cent of participants installed sound proof material.

9. **Problems due to noise pollution**

There are several ill effects which people experience due to noise pollution. If not controlled, noise pollution can lead to deafness. Problems faced by participants because of noise pollution are given in Table VII and Figure 6

TABLE VII

PROBLEMS FACED DUE TO NOISE POLLUTION

Problems	Percentage of sample N=100
General disturbance	99
Loss of sleep	89
Trouble communicating	65
Headache	60
Hypertension	45
Hearing loss	35
Stress	20
Cardio vascular effect	15
Increased blood pressure and heart beat	12
Fatigue and decreased work efficiency	10

It clear from the above Table noise pollution created several problems. More than 60 per cent of people reported that noise pollution would create general disturbance, headache, sleeplessness and difficulty in communication.

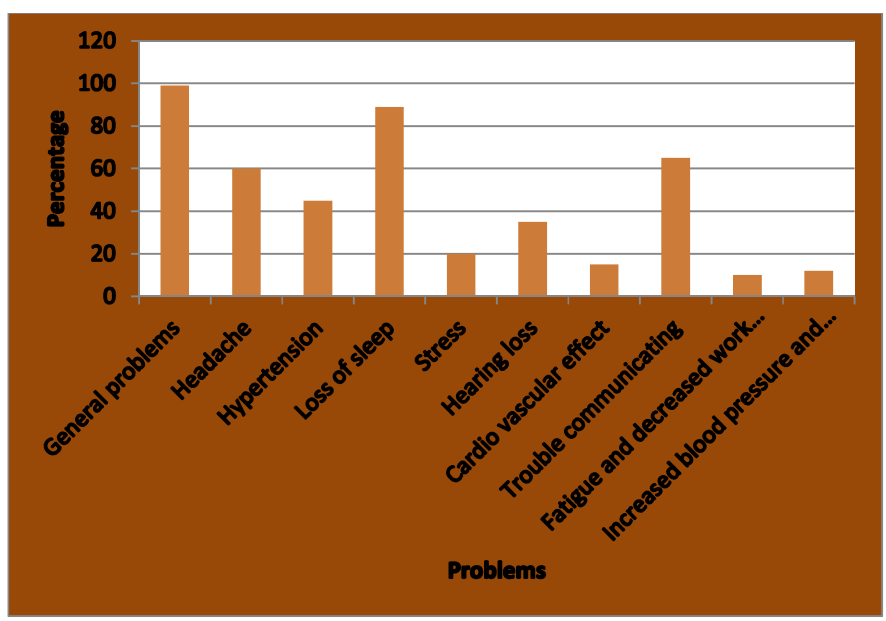


Figure 6

Problems due to noise pollution

10. **Age group responsible for noise pollution**

Age group responsible for noise pollution is shown in Table VIII and Figure 7

TABLE VIII

AGE GROUP RESPONSIBLE FOR NOISE POLLUTION

Age group	Percentage of sample N=100
Infants	14
Children	29
Teenager	25
Young adult	25
Adulthood	5
Elders	2

It is seen from the above Table that more than 25 per cent of the sample expressed that the children, teenagers and young adults create more noise.

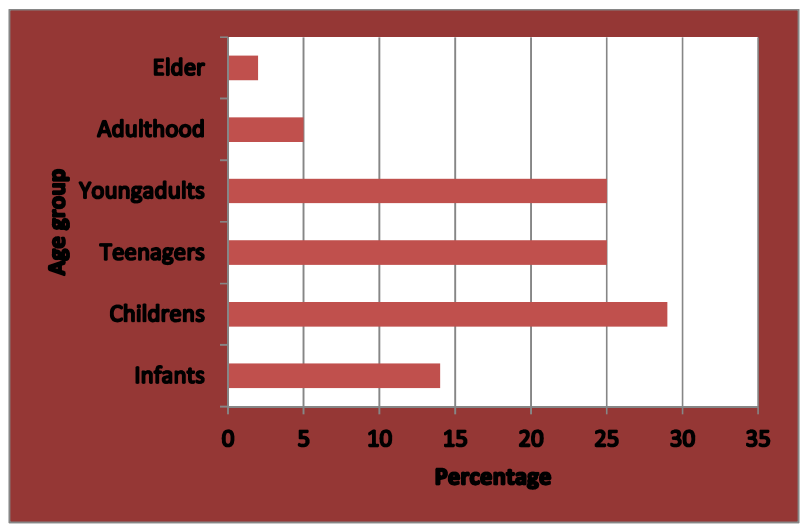


Figure 7

Age group responsible for noise pollution

11. **Age group most affected by noise pollution**

There is a group which is more sensitive towards noise. Age group most affected by noise pollution is given in Table IX and Figure 8.

TABLE IX

AGE GROUP MOST AFFECTED BY NOISE POLLUTION

Age group	Percentage of sample N=100
Elders	35
Infants	25
Children	25
Teenager	8
Young adult	5
Adulthood	2

It is noted from the above Table that 35 per cent said that elders were highly affected. The teenagers and young adults were not affected by noise as pointed by selected people they were the people who used to produce lots of noise

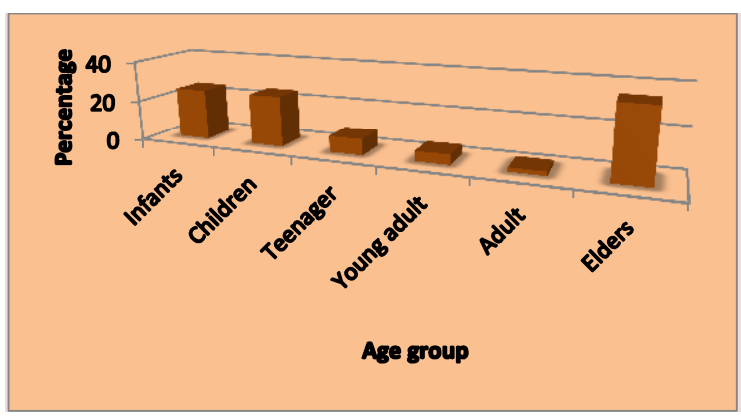


Figure 8

Age group most affected by noise pollution

12. **Awareness on rules and regulation to prevent noise**

There are certain rules and regulations established by government to prevent noise pollution. Awareness on rules and regulation regarding noise is presented in Table X and Figure 9.

TABLE X

AWARENESS ON RULES AND REGULATION TO PREVENT NOISE

Awareness	Percentage of Sample N=100
Yes	89
No	11

A majority of 89 per cent of participants were aware that there were certain rules and regulations for prevention of noise pollution remaining 11 per cent of participants were not aware of the rules and regulations.

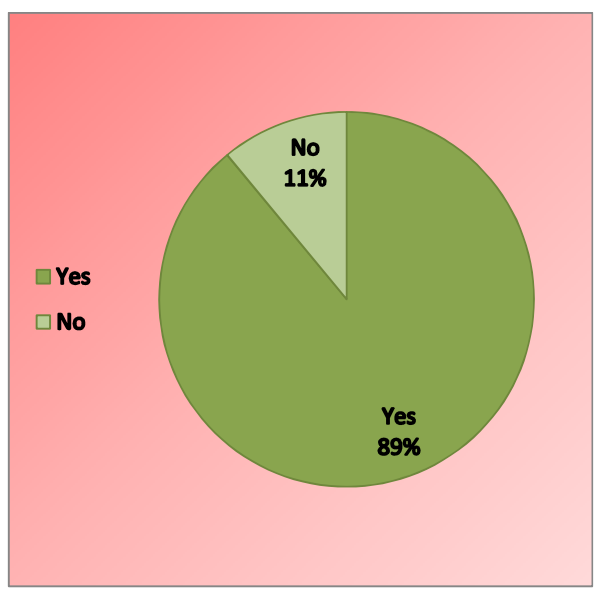


Figure 9

Awareness on rules and regulation to prevent noise

13. **Suggestions to reduce noise pollution**

Suggestions given by selected people on noise pollution are depicted in Table XI and Figure 10.

TABLE XI

SUGGESTION TO REDUCE NOISE POLLUTION

Suggestion	Percentage of sample N=100
Awareness on rules and regulations	45
Sound installation materials	40
Prohibition of horns in residential areas	25
Awareness on health effect due to noise pollution	21
Planting more trees	10
Protection devices	3

It is evident from above Table that selected people gave many suggestions to reduce noise pollution. Forty five per cent of participants believed that people should be aware of rules and regulations regarding noise, 40 per cent of participants told that sound insulation to buildings were more important whereas 21 per cent people told that awareness should be on health effects due to noise pollution.

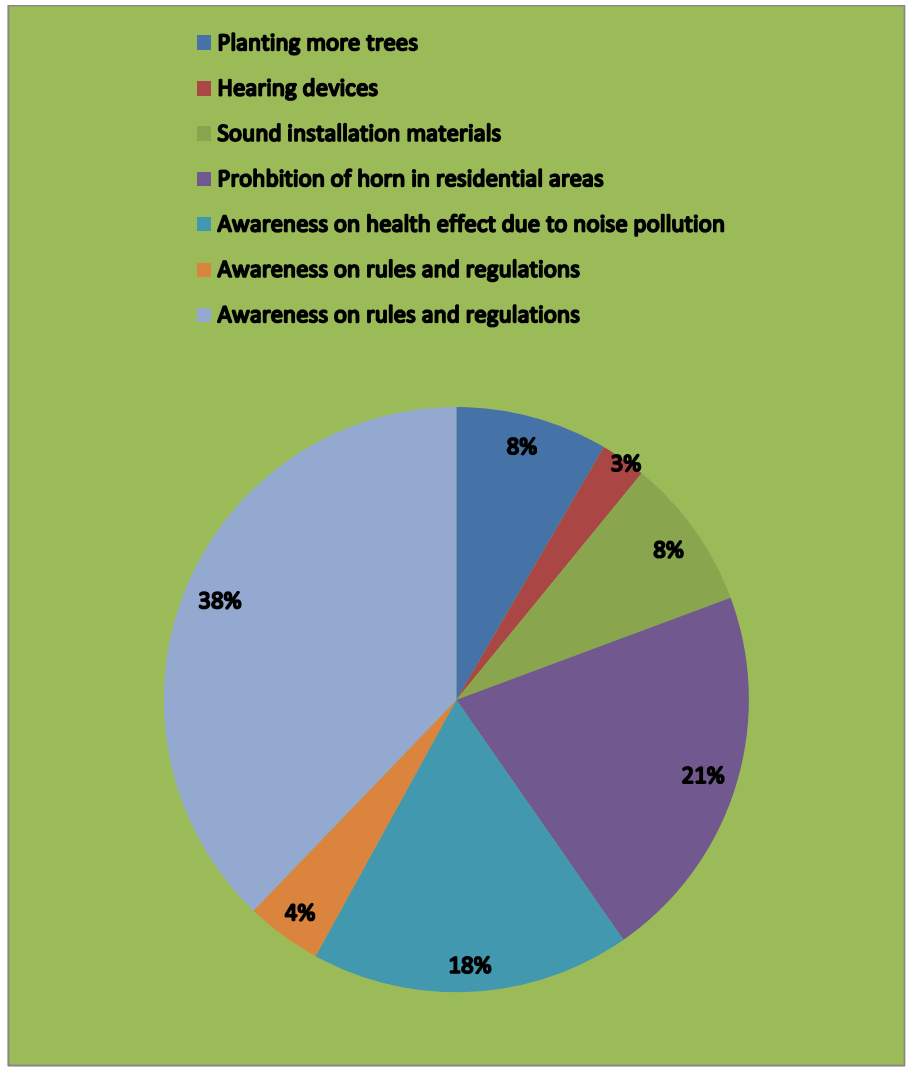


Figure 10

Suggestions to reduce noise pollution

B .Noise levels in the commercial area

This aspect consisted of the following headings

- Measuring sound level during weekdays in day time and night time
- Measuring sound level during weekends in day time and night time
- nosiest place and time in commercial area

1. **Measuring sound level during weekdays in day time and night time:**

Sound level was measured using sound level meter in Brook Fields and Fun Republic Mall in week days in both day and night time. Three readings were taken at different time of the day and average was calculated.

Readings taken and average calculated in Brook Fields Mall during week day in day time is depicted in Table XII and Figure 11.

TABLE XII

SOUND LEVEL IN BROOK FIELDS DURING WEEKDAYS (DAYTIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	85.4	87	85	85.8
Food court	82.3	83	85	83.4
Corridors	80	83	81	81.3
Lift	74.3	76.9	88.9	80
Escalators	85.8	87.6	88	87
Stairs	72.5	70	71	71.1

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during day is 65 dB. The sound level during day time in all the locations had more decibels then the recommended level.

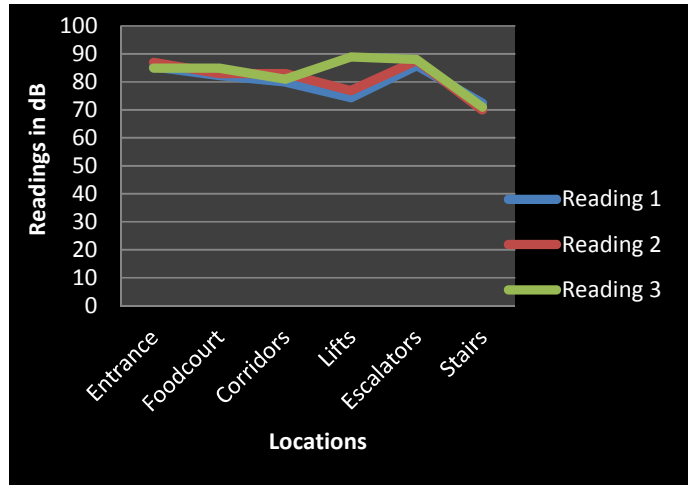


Figure 11

Sound level in Brook Fields Mall during weekdays (daytime) in dB

Readings taken and average calculated in Fun Republic Mall during week day in day time is depicted in Table XIII and Figure 12.

TABLE XIII

SOUND LEVEL IN FUN REPUBLIC MALL DURING WEEKDAYS (DAY TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	90	87	86.6	87.8
Food court	89.3	85	90	88.1
Corridors	70	79	81.2	76.7
Lift	73	71.9	70.1	72.6
Escalators	85.8	77.6	88	83.8
Stairs	79.5	79	80	79.5

Three different readings during different timings of day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during day is 65 dB. The sound level during day time in all the locations had more decibels than the recommended level.

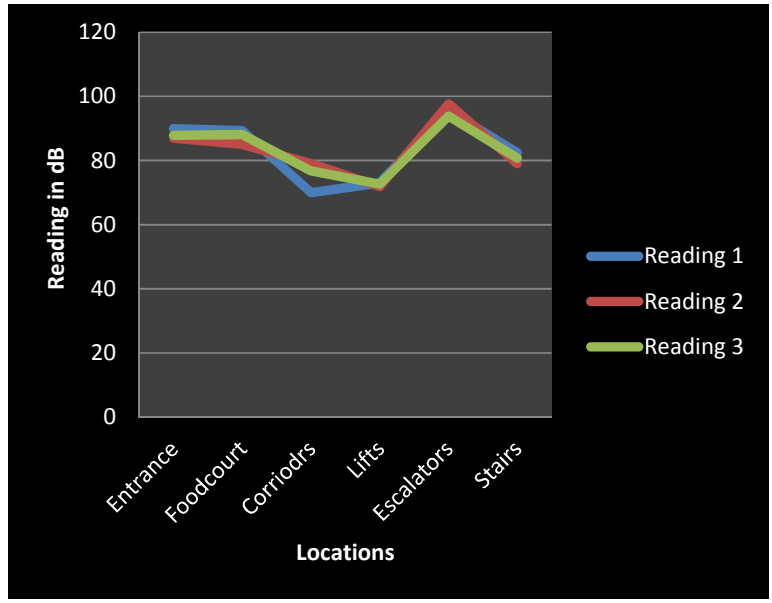


Figure 12

Sound level in Fun Republic Mall during weekdays (daytime) in dB

Readings taken and average calculated in Brook Fields Mall during week day in night time is depicted in Table XIV and Figure 13.

TABLE XIV

SOUND LEVEL IN BROOK FIELDS DURING WEEKDAYS (NIGHT TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	85.4	87	85	85.8
Food court	91	90	90.5	90.5
Corridors	90.2	92.7	95	92.6
Lift	80.3	85.9	80.9	82.3
Escalators	88	90	88.1	88.7
Stairs	72.5	70	71	71.1

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during night is 55 dB. The

sound level during night time in all the locations had more decibels then the recommended level.

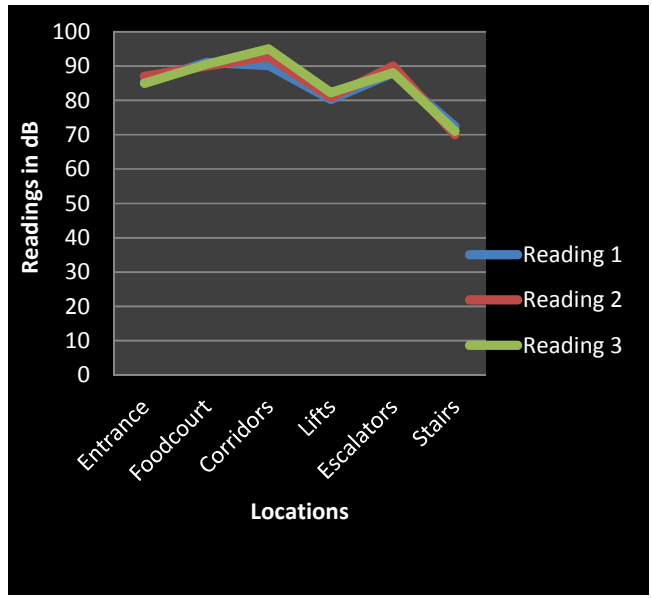


Figure 13

Sound level in Brook Fields Mall during weekdays (night time) in dB

Readings taken and average calculated in Fun Republic Mall during week day in night time is depicted in Table XV and Figure 14.

TABLE XV

SOUND LEVEL IN FUN REPUBLIC MALL DURING WEEKDAYS (NIGHT TIME)

Sound level in dB				
Locations	**Reading 1**	**Reading 2**	**Reading 3**	**Average**
Entrance	90	95	96.6	93.8
Food court	91.3	88	90	89.7
Corridors	80	79	79	79.3
Lift	73	71.9	70.1	72.6
Escalators	88	80.6	88	85.5
Stairs	77.5	78	80	78.5

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during night 55 dB. The sound level during night time in all the locations had more decibels then the recommended level.

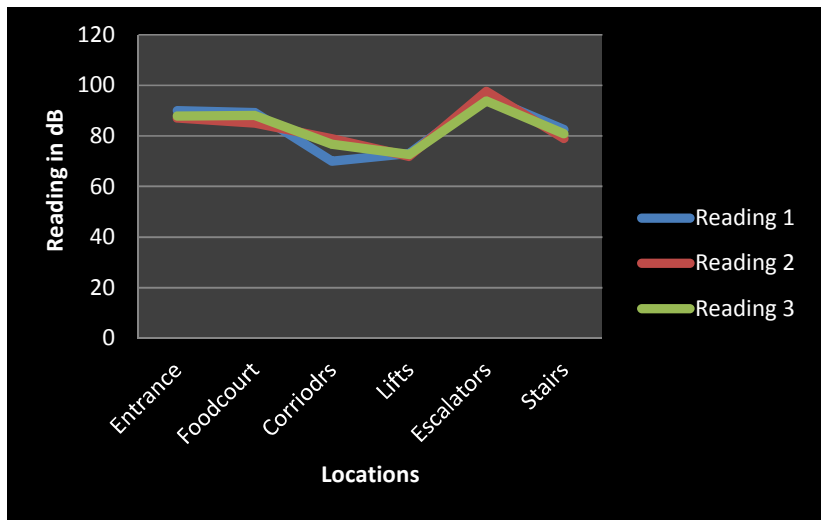


Figure 14

Sound level in Fun Republic Mall during weekdays (daytime) in dB

2. **Measuring sound level during weekends in day time and night time:**

Sound level was measured using sound level meter in Brook Fields and Fun Republic Mall in weekends in both day and night time. Three readings were taken at different time of the day and average was calculated.

Readings taken in Brook Fields Mall during weekends in day time is depicted in Table XVI and Figure 15.

TABLE XVI

SOUND LEVEL IN BROOK FEILDS MALL DURING WEEKENDS (DAY TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	85.6	86.9	85.7	86
Food court	90.2	89	95.9	91.5
Corridors	83.3	84.3	81	82.8
Lift	77	80	78.9	78.6
Escalators	89	89.9	87	88.6
Stairs	80	77	75.1	77.3

Three different readings during different timings of day were taken in different location. According to National Ambient noise level standards the recommended sound level in commercial areas during day is 65 dB. The sound level during day time in all the locations had more decibels then the recommended level.

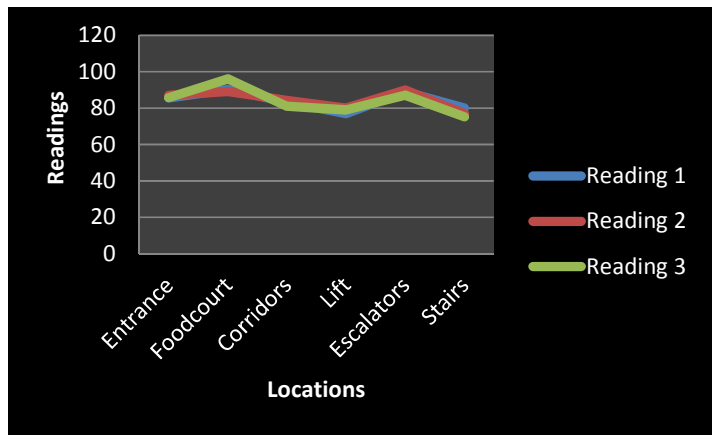


Figure 15

Sound level Brook Fields Mall during weekends (day time) in dB

Readings taken in Fun Republic Mall during weekends in day time is depicted in Table XVII and Figure 16.

TABLE XVII

SOUND LEVEL IN FUN REPUBLIC MALL DURING WEEKENDS (DAY TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	90	86.9	88.7	88.5
Food court	90.2	89	84.9	88
Corridors	88.1	86.6	80.1	84.9
Lift	77	76.9	80	77.9
Escalators	89.3	89.1	83.9	87.4
Stairs	72.8	81.9	85.1	79.9

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during day is 65 dB. The sound level during day time in all the locations had more decibels then the recommended level.

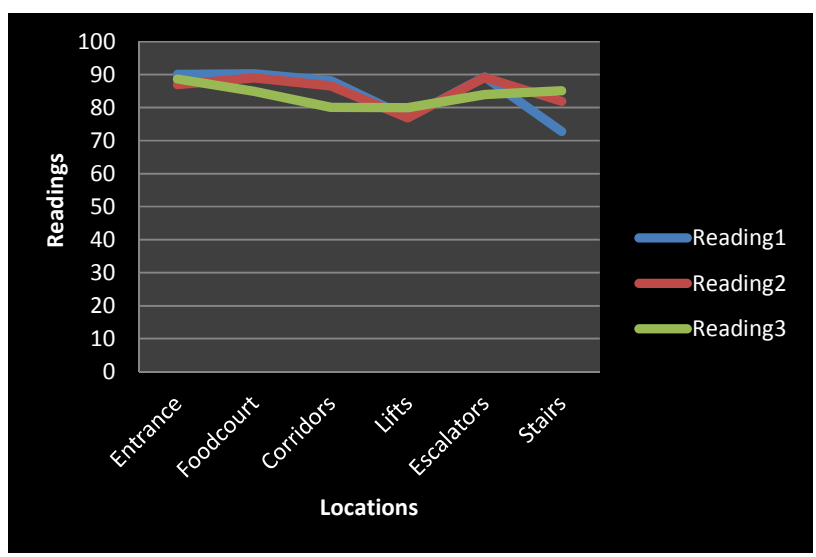


Figure 16

Sound level in Fun Republic Mall during weekends (day time) in dB

Readings taken in Brook Fields Mall during weekends in night time is depicted in Table XVIII and Figure 17.

TABLE XVIII

SOUND LEVEL IN BROOK FEILDS MALL DURING WEEKENDS (NIGHT TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	90	91.9	89	90.3
Food court	95	98	99	97.3
Corridors	88.1	86.9	85	86.6
Lift	79.9	80	85	81.6
Escalators	90.3	88.1	89	89.1
Stairs	78	80	81	79.6

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during night 55 dB. The sound level during night time in all the locations had more decibels then the recommended level.

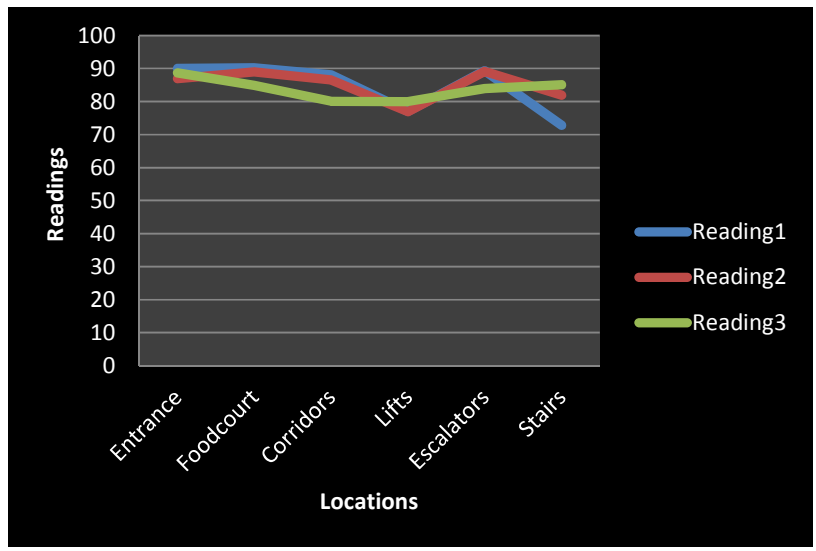


Figure 17

Sound level Brook Fields Mall during weekends (night time) in dB

Readings taken in Fun Republic Mall during weekends in night time is depicted in Table XIX and Figure 18.

TABLE XIX

SOUND LEVEL IN FUN REPUBLIC MALL DURING WEEKENDS (NIGHT TIME)

Locations	Sound level in dB			
	Reading 1	Reading 2	Reading 3	Average
Entrance	89	91.9	90	90.3
Food court	94.6	90	96	93.5
Corridors	88.1	86.9	85	86.6
Lift	78	80	75	77.6
Escalators	89.3	88.1	89	68.4
Stairs	75	80	79	78

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during night 55 dB. The sound level during night time in all the locations had more decibels then the recommended level.

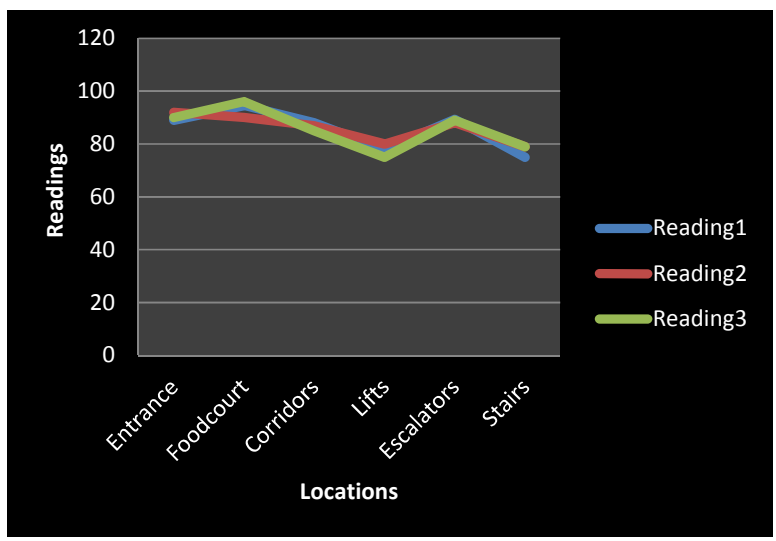


Figure 18

Sound level Fun Republic Mall during weekends (night time) in dB

3. Noisiest place and time commercial area

The average noise level in Brook Fields Mall during weekdays and weekends on day time and night is shown in table XX

TABLE XX

AVERAGE OF SOUND LEVEL IN BROOK FEILDS MALL IN dB

Location	Sound level in dB			
	Weekday		Weekend	
	Day	Night	Day	Night
Entrance	85.8	85.5	86	88.5
Food court	88.4	90.5	91.5	88
Corridor	81.3	92.6	82.8	84.9
Lift	80	82.3	78.6	77.9
Escalator	87	88.7	88.6	87.4
Staircase	71.1	71.1	77.3	79.9

It is clear from the above Table that the average noise levels in Brook Fields Mall during weekends were noisier. When comparing day time and night, the noise was more during night time in almost all locations of the mall

The average noise level in Fun Republic Mall during weekdays and weekends on day time and night is shown in table XXI

TABLE XXI

AVERAGE OF SOUND LEVEL IN FUN REPUBLIC MALL IN dB

Location	Sound level in dB			
	Weekday		Weekend	
	Day	Night	Day	Night
Entrance	87.8	93.8	90.3	90.3
Food court	88.1	89.7	97.3	93.5
Corridor	76.7	79.3	86.6	86.6
Lift	72.6	72.6	81.6	77.6
Escalator	83.8	85.5	89.1	88.4
Staircase	79.5	78.5	79.6	78

It is clear from the above Table that in Fun Republic mall weekends were nosier. When comparing day and night time, the noise was more during night in almost all locations.

V. Summary and conclusion

The state of discomfort and restlessness to human beings caused by unwanted high intensity sound is noise. Noise pollution affects both health and behaviour. Noise can damage psychological health. Noise pollution can cause trouble, hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Furthermore, stress and hypertension are the leading causes to health problems. Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life. Usually 80 db is the level at which sound becomes physically painful. Humans, animals, plants and even inert objects like buildings and bridges have been victims of the increasing noise pollution caused in the world. Be it human or machine-created, noise disrupts the activity and balance of life. Hence a study was conducted on 'Computing noise level in commercial areas' with the following objectives:

- Estimate the noise level in commercial areas.
- Study the major sources of noise pollution produced in commercial areas.
- Find out the measures adopted by the people to control noise pollution.
- Estimate the peak time of noise.
- Find out the age group mainly responsible for causing noise pollution.
- Study the major problems faced by people due to noise pollution.

The methodology on "Computing the noise level in commercial areas" consisted of two phases:

- Conducting survey from hundred participants in two selected areas Brook Fields mall in RS Puram and fun republic mall in Peelamedu.
- Estimating the noise level in two selected commercial areas during weekdays and weekends in day time and night.

Coimbatore city was selected for the research study which is industrial place having many commercial areas. Hundred Samples were selected using purposive sampling method. An Interview method was used to collect data using schedule. The noise levels in selected commercial areas were measured using sound level meter. Three consecutive readings were taken in different locations of the mall, during weekdays and weekends in day time and night.

The findings of the study are summarised below:

1. **The findings of the survey**

- **Background information:** Hundred participants were surveyed in which 60 per cent were female and remaining 40 per cent were male. Thirty per cent were under the age group of 20-40 including both female and male and remaining 70 per cent were under the age group of 40-60 both female and male.

- **Awareness on noise pollution:** All the participants were aware of noise pollution.

- **Tolerance limit:** Fifty five per cent of people said that 60-85 dB was safe for human ears, thirty five per cent of people said that 85-100 dB was safe. Ninety per cent of people said that 100-120dB was harmful for ears.

- **Sources of noise pollution:** There were several sources of noise in commercial space such as vehicles, people talking with each other, costumers making purchasing and visitors moving from one place to other. Events and shows such as singing and dancing competitions were conducted in commercial malls, which are also responsible for noise pollution. Commercial place had lots of entertainment sources such as games and movies which also led to noise.

- **Day of experiencing noise pollution:** Sixty five per cent of participants said that they experienced noise mostly in weekends and

remaining 35 per cent of participants experienced noise even in weekdays.

- **Frequency of visit to mall:** A majority of 73 per cent preferred to visit in weekends and remaining 27 per cent people preferred to visit in weekdays among which ten per cent visit weekly once and twelve per cent more than twice in a week.

- **Reason for visiting to mall:** The people visited mall for different purposes. Majority of 45 per cent people came to mall for doing shopping and 20 per cent of people liked to come for get together. There were people who preferred to come for eating, movie and entertainment purpose. Only few people came for meeting purpose.

- **Installation of sound proof material:** A majority 75 per cent of people did not installed sound proof materials only 25 per cent of participants installed sound proof material in mall.

- **Problems due to noise pollution:** More than 60 percent of people reported that noise pollution would create general disturbance, headache, sleeplessness and difficulty in communication.

- **Age group responsible for noise pollution:** More than 25 per cent of people pointed out that children, teenagers and young adult created more noise.

- **Age group affected by noise pollution:** Thirty five per cent said that elders were highly affected. The teenagers and young adults were not affected by noise because they were the people who used to produce lots of noise.

- **Awareness on rules and regulations regarding noise:** Only 89 per cent of participants were aware that there were certain rules and

regulations for prevention of noise pollution remaining 11per cent of participants they are not aware of rules and regulations.

- **Suggestion to reduce noise pollution:** Selected people gave many suggestions to reduce noise pollution. Forty five per cent of participants believed that people should be aware of rules and regulations regarding noise, 40 per cent participants told that sound insulation material to buildings are more important whereas 21 per cent people told that awareness on health effects due to noise, would help to reduce noise.

2. Estimating the noise level in two selected commercial areas:

Three different readings during different timings of the day were taken in different locations. According to National Ambient noise level standards the recommended sound level in commercial areas during night is 55 dB and in day time is 65 dB. In all the locations sound level was higher than the recommended, both during week days and weekends during day time and night.

Conclusion:

The problem of noise pollution needs solution at individual, community and government levels. On the one hand, it needs people awareness and education, on the other hand, needs strict enforcement of laws and programmes by the community and the government. Noise abatement programmes focus attention on noise reduction and noise control.

Intensity of noise may be reduced by enclosure of machinery with sound absorbing materials and by replacing the noise producing machines with quiet alternatives. Similarly noise pollution can be controlled at source points by proper oiling and greasing of the machines, by providing silencers to the machines and by reducing the amplitude of existing forces.

It can also be reduced by increasing the distance between the source and receiver of the noise, by proper layout of the buildings, by deflecting the path of the sound waves, and by protecting the individuals through mechanical devices. Road side plantation is an effective measure for controlling noise pollution. Similarly rail lines, roads, airports and industries should be located away from the residential areas. Vehicles plying on city roads, generators and air conditioners should be forced to use silencers. Similarly guidelines should be prepared and adopted for the playing of loud speakers and arranging public festivals and dances etc

Recommendations:

- Awareness can be created among people about rules and regulations related noise so that miseries which are being caused through such pollution can be minimised.

- Maximum restrictions should be imposed on the use of loudspeakers.

- Raising public awareness about the effect of noise pollution is the need of the hour.

- Government should strengthen the laws to control the noise pollution.

- Strengthening laws and governmental efforts to control noise pollution.

- Networks should be established among environmental professionals, governmental and all other activist groups working on noise pollution issues.

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APPENDIX I

Interview schedule to elicit information on “computing the noise level in commercial areas”.

1. Name of the interviewee _____

2. Address _____
   _____
   _____

3. Are you a permanent resident in Coimbatore?
   Yes ☐
   No ☐

4. You are living in your house
   a. More than five years ☐
   b. Less than five years ☐

5. Do u know what is noise pollution?
   Yes ☐
   No ☐

6.
a. Do you know the decibels safe for human ear?
   65-80dB ☐
   80-100dB ☐
   100-120dB ☐
b. Do you now the decibel harmful for human ear?
   65-80dB ☐
   80-100dB ☐
   100-120dB ☐

7. Do you know the tolerance limit of human ear? ☐

8. What are the sources of noise pollution in mall

a. Vehicles ☐

b. People (there conversation, purchasing, moving from one place to other etc) ☐

c. Events (dancing, singing etc) ☐

d. Gaming zone ☐

e. Cinemas ☐

f. Others (fires works, loud speakers etc) ☐

9. Which day you experience noise pollution?

a. Week day ☐

b. Week end ☐

10. How many times do you visit a mall?

a. Weekly once ☐

b. More than twice in a week ☐

c. Only weekends ☐

11. For what purpose you visit mall?

a. Eating ☐

b. Entertainment ☐

c. Meetings ☐

d. Shopping ☐

e. Get together ☐

f. Movie ☐

12. Have you Installed any sound proof material to your building?

Yes ☐

No ☐

13. What are the problems you faced due to noise pollution?

a. Problems ☐
b. General disturbance ☐
c. Headache ☐
d. Hypertension ☐
e. Loss of sleep ☐
f. Stress ☐
g. Hearing loss ☐
h. Cardio vascular effect ☐
i. Trouble communicating ☐
j. Fatigued and decreased work efficiency ☐
k. Increased blood pressure and heartbeat ☐

14. According to you which age group is responsible for noise pollution?

a. Infants ☐
b. Children's ☐
c. Teenagers ☐
d. Young adult ☐
e. Adults ☐
f. Elders ☐

15. According to you which age group is affected by noise pollution?

a. Infants ☐
b. Children's ☐
c. Teenagers ☐
d. Young adult ☐
e. Adults ☐
f. Elders ☐

16. Are you aware on rules and regulation regarding noise?

Yes ☐

No ☐

17. Please give some suggestion to reduce noise pollution

_____

_____