

Usage Of Various Construction Equipment, Tools at Construction Site & Noise Impact on Human Health Near Koyali in Vadodara

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Abstract- There are various industries in the world, risks and inherent hazards are involved in the industries, construction industry one of them where environmental issues are involved and due to movement of construction equipment, operation of hand power tools lot of environmental issues is being elevated by the operation of construction equipment e. g. dust, land and noise pollutions. Most of the workers in construction industry in India and other part of the world are usually exposed to excessive noise in their workplace. The noise which has been recorded in BS-IV Flare Project, near Koyali Vadodara are as follows: chop saw machine 116 dbA max, Plate compactor 112 dbA Max. AG-7 grinding machine 110 dbA Max, mobile crane (110 MT) 105 dbA Max, and transit mixture 93 dbA Max recorded from one-meter distance. On the construction site, noise pollution impacts millions of people on daily basis. The most common health problem it causes is noise induces hearing loss (NIHL). Exposure to loud noise can also cause high blood pressure, heart disease, sleep disturbance, and stress. The abatement of noise pollution and its control on construction site / workplace must ensure through adequate awareness training, lectures, announcement through PA system, radio talks, news media, and other programs.

Index Terms- Exposure to construction industry workers, Hearing loss, Noise induced-hearing loss, (NIHL) power tools operations.

I. INTRODUCTION

In construction industries noise or unwanted sound is a major occupational and environmental hazard, causing significance hearing loss, annoyance, sleep disturbance, fatigue, stress, speech interference, and hypertension. Although the extra-auditory effects of high-level noise exposure have been reported, noise-induced hearing loss (NIHL) has long been recognized as the primary and most direct health effect of

excessive noise exposure. In the construction industries various sort of hand tools / power tools, equipment and other mechanisms are used for daily activities for the development of urban areas, plants etc. which create numerous noise pollution which is already inherently available in the equipment sound. There are several health risks associated with construction noise that adversely affects the lives of millions of people which work in the construction industries.

In India almost all construction sites have significant noise pollution issues but also there are several control measures are adopted that can be reduced the amount of noise generated at work site.

II. RESEARCH PROBLEM

A significant high noise arises from construction equipment and power tools in the construction industry due to high volume of construction equipment and power tools are used which is not maintained properly and maintenance is not done periodically when required in the construction site, most of the time it is seen that the arrangements and maintenance of construction equipment is done on temporary basis due to deployment of small-scale contractor.

III. OBJECTIVE

We aimed to describe some of the most serious health effects associated with noise pollution in the construction industries, summarize exposures from several highly prevalent noise sources based on equipment used in the construction industries. In order to fulfil the purpose to reduce noise impact on human health, the following goal has been determined:

- (a) To study the impact of noise pollution in industries and at construction site.
- (b) To measure the noise level at various construction work sites at different timings of the day in Koyali, Vadodara.
- (c) Comparative Assessment of noise level with respect to prescribe standards for various zone.
- (d) Identification and consideration of suitable mitigation and abatement measures.

IV. METHODOLOGY


Methodology based on Comparative Study process consisted of the following types of activities:

Study of Project Documents: the documents related to noise pollution were studied to understand the dissertation objectives, its main components, its boundaries etc.

Study of Laws and regulations: Laws and regulations enacted by Government of India and study State relevant to Noise Pollution were studied for comparative study and analysis of monitoring.

Study of Guidelines, Standards etc. Various documents and publications of the Ministry of Environment and Forest (MoEF & CC) and Indian legislation for Noise Pollution were studied for Study and exercise on site by using sound level meter at different selected location.

Noise Monitoring Instruments :



MEXTECH™
INSTRUMENTS OF TOMORROW
SOUND LEVEL METER SL36




Application: Applicable to measure the Sound level of environment, Machinery, Vehicles, Ships & Other Noise.

Specifications:-

Measurement range	: LP -30~130dB (A)
Resolution	: 0.1 dB
Accuracy	: ±1.5dB

Features :-

- LCD Display with Backlight & Torch.
- Meter Permits the option of "A" Weighting
- Response Type : Slow(1000ms), Fast(125ms)
- Max Min function.
- Low Battery Indication
- Overload Indication. : < 30dB (LN Display) > 130dB (OL Display)
- Auto/Manual Power Off.
- 1/2 inch Electret Condenser Microphone Sensor.
- Power Supply : 9 Volt battery .
- Unit Size : 192 X 53.8 X 35 mm .
- Weight : 169 gms (Including Battery)
- Accessories: Instruction Manual, 9V Battery, Windscreen.



Site Selection Criteria :

The first step in implementing a successful construction noise monitoring program is to identify noise-sensitive areas in the vicinity of the construction site which is situated in the industrial zone of Vadodara, Koyali. In the plant, Noise-sensitive areas include construction site, Labourer rest shed, two nos.

of site store and other areas where excessive noise may cause disturbance or harm to the occupants.

To determine the most effective monitoring locations, a thorough site survey shall be conducted and consider the specific noise sources and transmission pathways associated with the construction activities. Monitoring equipment shall be placed at strategic points to capture accurate and representative noise levels. In general, monitoring locations shall be placed close to the noise-sensitive areas but also in a way that ensures minimal obstructions or barriers affecting noise propagation.

Noise Level Limit for Human Being as per CPCB

S. No.	Name	Day	Night
1	Residential	55	45
2	Educational	55	45
3	Commercial	70	70
4	Industry	75	70
5	Silent Zone	45	40

S. No.	Name	Range
1	Auditorium	20-25
2	Cinemas	30-35
3	Hospitals	35-40
4	Hotels	35-40
5	Office / Class	40-45
6	Bank / Large Office	45-50
7	Restaurant	50-55
8	DG	75

Field measurement.

The sound levels of various construction work machines are taken at different distances while in use to evaluate their sound levels at site near Koyali Vadodara. The digital sound level meter was held at a

height of about 1.2meters to 1.5 meters above the ground level.

Field dataset for equipment and tools.

The noise levels of the various machines identified in this evaluation are presented and shown below.

TABLE-5. NOISE LEVELS OF SAMPLED MACHINES.

S. No.	Source from (equipment)	Distance Measure-Meter	Noise Level (dB)	Leq	L.max	L.Min	Standard	
				(dB)	(dB)	(dB)	Day (dB)	Night (dB)
5	Roller Compactor 5-T	1-M	87, 95	91	95	87	75	70
		3-M	85, 86	85	86	88	75	70
		5-M	80, 84	82	80	84	75	70
		10-M	72, 74	73	74	72	75	70

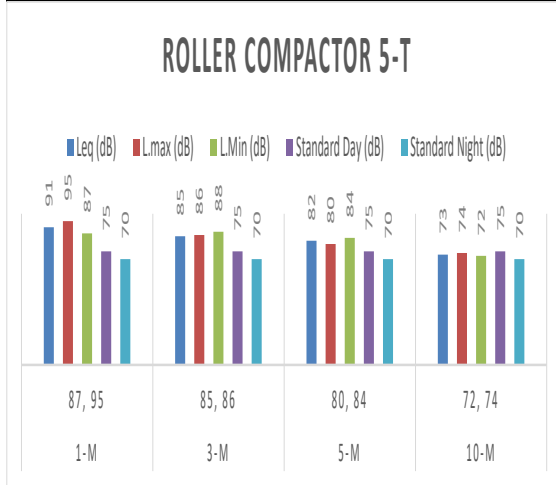


TABLE-7. NOISE LEVELS OF SAMPLED MACHINES

S. No.	Source from (equipment)	Distance Measure-Meter	Noise Level (dB)	Leq	L.max	L.Min	Standard	
				(dB)	(dB)	(dB)	Day (dB)	Night (dB)
7	Plate Compactor (B)	1-M	109, 112	110	112	109	75	70
		3-M	105, 105	105	105	105	75	70
		5-M	97, 99	98	99	97	75	70
		10-M	90, 90	90	90	90	75	70

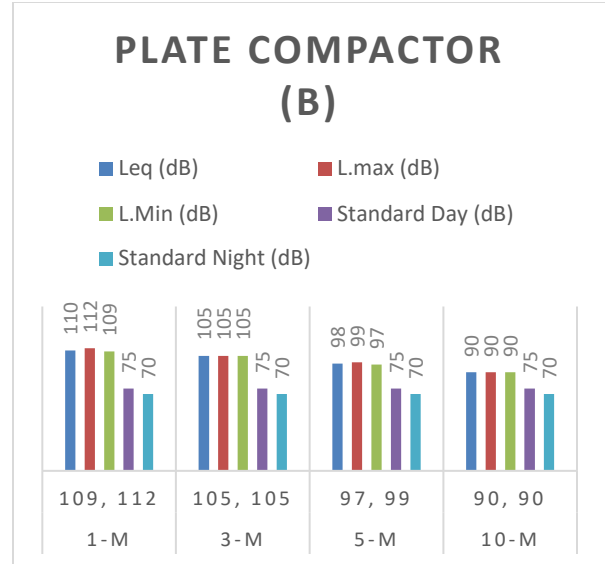


TABLE-8. NOISE LEVELS OF SAMPLED MACHINES

S. No.	Source from (equipment)	Distance Measure-Meter	Noise Level (dB)	Leq	L.max	L.Min	Standard	
				(dB)	(dB)	(dB)	Day (dB)	Night (dB)
8	Mobile Crane 110-MT	1-M	103, 109	104	109	103	75	70
		3-M	93, 109	104	109	93	75	70
		5-M	80, 93	88	93	80	75	70
		10-M	79, 88	84	88	79	75	70

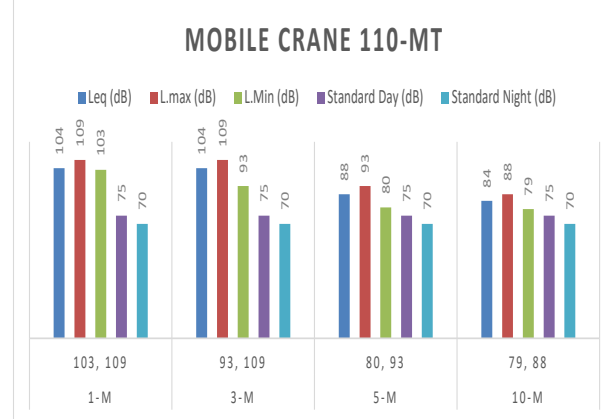
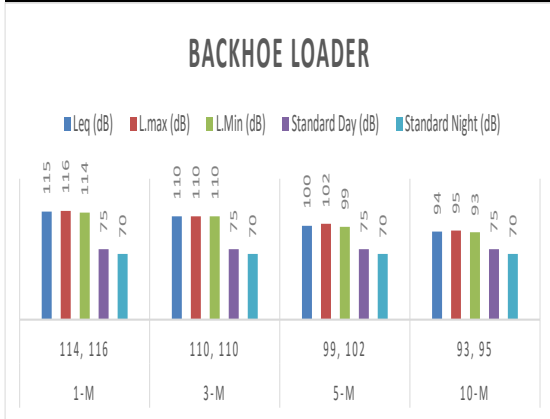


TABLE-9. NOISE LEVELS OF SAMPLED MACHINES

S. No.	Source from (equipment)	Distance Measure-Meter	Noise Level (dB)	Leq	L.max	L.Min	Standard	
				(dB)	(dB)	(dB)	Day (dB)	Night (dB)
9	Backhoe loader	1-M	114, 116	115	116	114	75	70
		3-M	110, 110	110	110	110	75	70
		5-M	99, 102	100	102	99	75	70
		10-M	93, 95	94	95	93	75	70



V. EFFECTS OF NOISE POLLUTION ON HEALTH

Noise pollution impacts millions of people on daily basis. The most common health problem it causes is Noise induces hearing loss (NIHL).

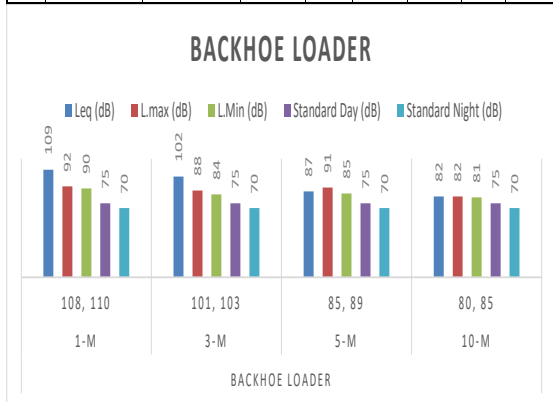
Exposure to loud noise can also cause high blood pressure, heart disease, sleep disturbance, and stress. These health problems can effect all age groups, construction workmen, and in the residential area especially children too.

Many children who live near noise airports or streets have been found to suffer from stress and other problems, such as impairments in memory, attention level, and reading skills.



TABLE-11. NOISE LEVELS OF SAMPLED MACHINES

S. No.	Source from (equipment)	Distance Measure-Meter	Noise Level (dB)	Leq	L.max	L.Min	Standard	
				(dB)	(dB)	(dB)	Day (dB)	Night (dB)
11	Backhoe loader	1-M	108, 110	109	92	90	75	70
		3-M	101, 103	102	88	84	75	70
		5-M	85, 89	87	91	85	75	70
		10-M	80, 85	82	82	81	75	70



The various problems generated due to noise pollution can be studied under two heads.

1. Auditory Problems
2. Non-Auditory Problems

Auditory Problems:

- a) Hearing Problem
The continuous exposure of unwanted sound for long duration may result in the damage of ear drums and subsequently loss of hearing.
- b) Auditory Fatigue:
By continuous exposure to noise of various intensities restlessness and tiredness occurs. It is known as auditory fatigue.

Non-Auditory Problems:

- a) Health issues
The non-auditory health issues triggered by noise pollution include the problems of cardiovascular system, nervous system, gastrointestinal, headache, nausea and vomiting, psychological disturbance, irritation etc.
- b) Sleeping Disorder
The noise of various intensities may disturb sleep.
The disturbance may include shorter sleep duration, frequently awaking and development of anxiety and irritation take place.
- c) Interference in communication
Noise pollution hinders the communication process in several ways between source and receiver.
- d) Psychological effects
Annoyance – Mainly aroused due to the unpleasant nature of some sounds. It causes adverse effects on task performance and behavior.
- e) Effect on wildlife
Noise has large impact on wildlife.
Generally, animals easily get disturbed with noise.

That's why in prohibited area like national parks and sanctuaries, the use of horn is prohibited.

VI. HIERARCHY OF CONTROL

The hierarchy of control creates a systematic approach to manage noise in your workplace by providing a structure to select the most effective control measures to eliminate or reduce the risk of certain hazards of noise that have been identified as being caused by the operations of the tools, tackles and construction equipments.

The hierarchy of control has six levels of control measures, the most effective measure is at the top of the hierarchy and the least effective is at the bottom. So the idea is that you start from the top of the hierarchy in choosing your control measure, and work your way down.

The hierarchy of control involves the following steps:

1. Elimination – removes the cause of danger completely.
2. Substitution – controls the hazard by replacing it with a less risky way to achieve the same outcome.
3. Isolation – separates the hazard from the people at risk by isolating it.
4. Engineering – using engineering controls, i.e. making physical changes, to lessen any remaining risk, e.g. redesign a machine by adding closer guards.
5. Administration – use administrative controls to lessen the risk, e.g. install signs, rotate jobs.
6. Personal Protective Equipment (PPE) – require your employees to wear PPE, e.g. provide gloves, earplugs, goggles, iridescent vests.

VII. RECOMMENDATIONS FOR CONTROL AND ABATEMENT OF NOISE POLLUTION IN THE WORKPLACE

1. Workers must be aware and educate about noise nuisance through adequate training, lectures, announcement through PA system, radio talks, news media, and other programs.

2. Periodical maintenance of equipment, tools, and other equipment. All automobile workshops and other industrial equipment should be located far from site area and those that are on roadsides and public places used to be re-allocated at other peripheral sites of the industry / construction area.
3. Noise produces from equipment / neighbor industries if possible can be controlled by covering the room walls with sound absorber as acoustic tiles or construction enclosures around the industrial machinery.
4. The hand power tools e. g. grinding machine is used 220 Volt, should be recommended to use 110 volt grinding machine.
5. A good and proper planning before starting construction activity at site is very important.
6. Selection of good quality equipment, tools is also helping to reduce noise at workplace.
7. The best way to protect the workers from noise disturbance is to locate the plant in isolated areas, so that the existing plant noise can be avoided.
8. Controlling the speed limit of vehicles near construction activity and its surroundings.
9. Planting of evergreen trees around or nearby areas of noise can proved to be effective measure for control of noise pollution as green trees reduce the intensity of noise.
10. To reduce the noise created by vehicles creation of 'No Vehicle Zone' around site office area is recommended.
11. Old vehicles and heavy earth moving machines (older than 15 years) without silencer and without proper maintenance should be banned at construction site.
12. Avoidance of unnecessary use of horn and reverse whistle at construction site
13. The role of NGOs, researchers and professionals, media and concerned individuals is significant in minimizing the environmental hazard of noise pollution.
14. Proper implementation of laws to control noise pollution and regular supervision is also one of the important ways to control noise pollution.
15. The workers exposed to noise can be provided with wearing devices as earplugs and earmuffs.

CONCLUSION

Noise pollution is a significant environmental problem in many construction sites and industrial plant areas, it is assume and predicted that in the near future the intensity of noise and complaints due to noise pollution will increase significantly because of rapid increase in construction activities and unplanned way of using construction equipment and awareness among the workmen and citizens, business activities, industrialization, technological development and exponential growth of construction equipment and tools both in private and public sector increased rapidly in construction site. Noise adversely affects general health and well-being in the same way as does chronic stress affect from high significant of noise in the workplace, the use of heavy earth moving equipment and tools at the constructions site. It adversely affects future generations by degrading residential, social, and learning environments with corresponding economic losses (Goines and Hagler, 2007). Several researchers worldwide have studied the construction noise pollution showing that noise pollution is becoming a severe problem in the construction environment, and Koyali in Vadodara is no exception to it. In Koyali, there is no sufficient study about the noise pollution and its effects on human health. In view of this, the present study was taken up to quantify noise intensity and to assess the effects of noise pollution in Koyali. This study also tried to formulate strategies for control of noise pollution in the study area. Since there is no separate places for establishing workshop/equipment maintenance, site stores, labour shed and site offices the study area was fall under as the industrial zone of Koyali. Based on the site location in industrial zone. Noise measurement was taken by using Integrating Sound Level Meter "MEXTECH SL 36". Readings were taken from four places of distance of noise source (0-1, 3, 5 and 10 meter distance, and morning 9-10 am, daytime 12 noon -1 pm and afternoon 3 pm – 4 pm) for site store and rest shed. The equipment and tools sample were collected during the month of February, March and April 2024 and whole study completed from January 2024 to May 2024. After recording Lmax, Lmin and Leq of the noise level, the result was compared with the standards of Noise Pollution (Regulation and Control) Rules- 2000, and found significantly high at construction site of Koyali.

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