



STUDY OF AVERAGE & MAXIMUM LEVEL OF NOISE RANGE AT BUILDING CONSTRUCTION SITE FOR WORKERS WELFARE

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Abstract:

Construction is one of the world's major industries, comprising a diverse variety of activities such as building, civil engineering, demolition, and maintenance. Construction activity is an unavoidable part of everyday living, thus noise issues are unavoidable. On construction sites, noise management is frequently referred to as a government regulation, and conscience noise control is unusual. This study looked into construction site noise pollution. Environmental specialists, on the other hand, are aware of the dangers, which are discussed as result/precautions below. Although it is impossible to collect 100% of recyclables or to be environmentally conscious, we can estimate some recovery and track key avoidance factors. A survey of 120 construction site employees from Chennai, Salem, and Coimbatore was conducted to examine health issues, hearing ranges, and noise/noise control range restrictions. Over the years, both experimental and epidemiological research has been undertaken, with the results revealing a rise in disease incidence during periods of noise exposure. Disability-adjusted life years (DALYs), which were acknowledged as an endpoints indicator for noise health risk assessment, is one of the most widely used methods for quantifying the human risk of illness.

Keywords: Noise pollution, workers, hearing, Stress, heart attack

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1. Introduction

Employers

are now responsible for preventing NIHL (noise-induced hearing loss [10]) by implementing engineering controls to limit hazardous noise exposures, audiometric screenings to evaluate the effects of exposure on personnel, as well as hearing loss [1] prevention program that include hearing protection devices (HPDs). The utility of HPDs, as well as how well they follow workplace standards, are at best inconclusive. As seen in the

following sections, there can be a significant difference between noise reductions in the lab and the "real world." It is widely assumed that most major corporations have hearing loss prevention strategies in place; it's not the case, however, for the majority of small and medium-sized enterprises. When these programmes are made available, they are typically ineffective. Although they are not generally



used, engineering methods to decrease noise sources are preferred. Technical solutions and expenses that can significantly reduce noise emissions are sometimes "sold to management" by emphasizing other benefits such as increased productivity or improved quality. Noise causes hearing problems, sleep problems, inefficiencies in people's work, and damaging vibration in structures [5]. According to a World Health Organization report, noise levels and temporal patterns, frequency distribution, noise sources (*site*, *power*, and *directivity*), noise transmission channels and room acoustics should all be thoroughly researched (*reverberation*). A parallel study of noise pollution protection and appropriate construction designs for medium to high-rise structures was included in this report.

Objectives:

- i. To apply active noise control in the construction through survey analysis of every psychology and physical effects.
- ii. To discuss worker health checks on a regular basis, measuring construction site's noise

level and taking precautions for workers health based on using machines and works.

2. Survey based noise emission estimation

For investigations of construction noise emission estimation, researchers have utilised two methods: the first investigates noise data from equipment, and the second from construction sites [13]. Because of noise generator tool/machine, standards/limits, this paper employed official criteria to determine the environmental cost of construction noise and concerns. To construct an exposure-response connection, researchers pooled relative hazards from various trials on the same type of noise. Noise exposure raises the risk of myocardial infarction in persons aged 25 to 74, according to the study, but had no influence on the risk of myocardial infarction in women [2]. The probability risk of myocardial infarction caused by construction noise was calculated using the background prevalence of myocardial infarction (Table 1 & fig 1).

Table 1. Myocardial infarction risk an as a result of construction noise

Sound Level, Ldn, (dB(A)) Age	< 60 (1)	60- 64 (2)	65- 69 (3)	70- 74 (4)	75 (5)	Disability Weight b,DW
25- 34	0.0105	0.0106	0.0112	0.0121	0.013	0.443
35- 44	0.0796	0.0808	0.0850	0.0924	0.1036	
45- 54	0.2059	0.2090	0.2197	0.2391	0.2681	
55- 64	0.3936	0.3995	0.4200	0.4570	0.5125	
65- 74	1.3436	1.3637	1.4336	1.5599	1.7493	



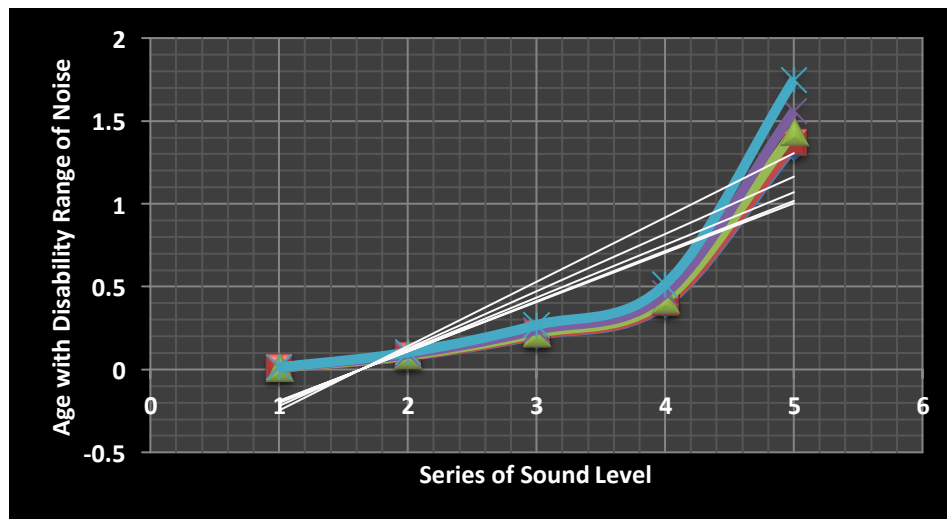


Figure 1. Impact range based on dB(A) with different age group

When researchers looked at the link between work history and NIHL (noise induced hearing loss), they discovered that out of five people who worked in extremely noisy environments for less than ten years, four had normal hearing and one

had a partial loss. Because of his age, it appeared that the noise effect on that guy was more powerful than on his co-workers (Age: 49). It's worth noting that the effect of age on hearing was taken into account while calculating the NIHL.

Table 2. Results of noise measuring in machines/vibration noise of the legal standard of noise

	<i>Age (years)</i>	<i>Work experience (years)</i>	<i>Noise intensity (db)</i>	<i>NIHL Right ear of all workers</i>	<i>NIHL Left ear of all workers</i>	<i>NIHL two ears of all workers</i>	<i>NIHL two ears > 85 db</i>
Minimum	24	3	56	1.5	0.5	0.9	8.2
Maximum	59	21	99.5	48.5	42.5	42.7	42.7
Mean	35.8	9.5	82.3	19.3	17.8	17.1	26.5
Standard Deviation	7.69	5.4	11.9	14.6	13.6	13.5	11.7



Table 3. Testing procedure with workers

<i>Central Frequency (Hz)</i>	250	500	1000	2000	4000	8000
<i>Maximum Acoustic Pressure Level (dB)</i>	44	26	28	37	44	41

3. Engineering Controls and Total Enclosures

Lighting may be necessary if employees need to observe the machinery[6]. If employees rely on the sound of equipment to determine its performance, they may need to be retrained or a durable microphone installed within the enclosure that sends the signal to a smaller adjustable loudspeaker at the worker's station. It is occasionally feasible to create a processor that integrates the expertise of the workers so that the machinery can automatically adjust to the best potential performance. To limit the amount of noise radiated, several technological measures change the noise source. This may be done in a number of different ways:

- ✓ Reducing the amount of noise produced by the source
- ✓ Modifying operating parameters to reduce noise production
- ✓ Adding intake and exhaust mufflers or silencers
- ✓ Vibration reduction by providing dampening
- ✓ Vibration isolation to reduce other structures' excitation
- ✓ Providing source acoustical shielding
- ✓ Using lagging or a partial or entire enclosure to enclose the source

Noise exposure among construction workers, hearing protection use, hearing difficulties, prevalence estimates for material hearing impairment and the incidence of material hearing impairment are discussed in % below table 4 [14].



Table 4. Noise in Construction

	Occupational Noise Exposure	Self- Reported Non-Use of HPDs	Self- Reported of Hearing Difficulty	Material Hearing Impairment	Material Hearing Impairment
Construction	51%	30%	14%	25%	9%
<i>Noise Level</i>	<i>Duration</i>	<i>Notes</i>		<i>Exposure points</i>	
80	5 hrs	Because there is no column for 5 hours, in the row that corresponds to 80 dB, add the values from the 4 and 1 hour columns.		16 + 4 = 20	
86	2 hrs	<i>Directly from table</i>		32	
96	45 mins	Because there is no column for 45 minutes, in the row that corresponds to 95 dB, add the values from the 30 and 15 minute columns.		65 + 32 = 97	
<i>Totla noise exposure points</i>				149	
<i>LEP, d</i>				86 to 87 dB	

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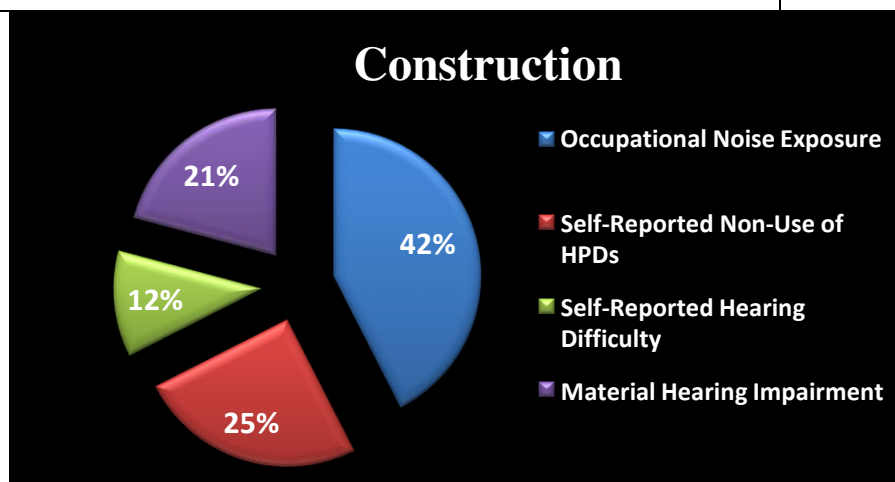


Figure 2. Prevalence & Incidence of Noise Explore



It is critical to ensure that noise measurement tools are correctly calibrated at all times. This requires validating the instrument's calibration acoustically during each day's use, as well as doing regular electronic inspections. The noise measuring methods to be employed are determined by the measurement objectives, which are to assess:

- The risk of hearing impairment
- The need for and appropriate types of engineering controls
- The “noise load” for compatibility with the type of job to be performed

➤ The background level necessary for communication and safety

The exposure from each job may now be calculated using noise levels and exposure periods (or partial exposure). To get their daily exposure total, or LEP, d, each partial exposure must be summed logarithmically.

When daily noise exposure consists of two or more periods with different noise levels [12], the combined impact of each must be considered instead of the effect of each. The allowable noise exposure levels are shown in Table 5 as a function of time.

Table 5. Permissible Noise Exposures

<i>Sound Level (dBA)</i>	<i>Permitted duration per workday (hrs)</i>	<i>Sound Level (dBA)</i>	<i>Permitted duration per workday (hrs)</i>	<i>Sound Level (dBA)</i>	<i>Permitted duration per workday (hrs)</i>
90	8.00	99	2.30	108	0.66
91	6.96	100	2.00	109	0.56
92	6.06	101	1.73	110	0.50
93	5.28	102	1.52	111	0.43
94	4.60	103	1.32	112	0.38
95	4.00	104	1.15	113	0.33
96	3.48	105	1.00	114	0.28
97	3.03	106	0.86	115	0.25
98	2.63	107	0.76	116	0.21

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We recorded noise levels for each activity reported by construction workers, as well as the percentage of time they used hearing protection when noise levels exceeded 85 decibels. For all employees in all crafts, the average full-shift noise exposure level was 81.4 dBA (Table 6).

Table 6. Required production ranges at construction site as per standards

Tools	<i>Average level dBA</i>	<i>Maximum level dBA</i>	<i>Required production (%)</i>



<i>Welding, Cutting Equipment</i>	94.9	122.8	4%
<i>Other Hand Power Tool</i>	95.4	118.3	11%
<i>Hand Power Saw</i>	97.2	114.0	25%
<i>Screw Gun, Drill Motor</i>	97.7	123.7	29%
<i>Roto Hammer</i>	97.8	113.5	61%
<i>Chopsaw</i>	98.4	117.7	32%
<i>Rattle Gun</i>	98.4	131.1	0%
<i>Stationary Power Tool</i>	101.8	119.8	67%

<i>Powder Actuated Tool</i>	103.0	112.8	81%
<i>Chipping Gun</i>	103.0	119.2	33%
Trade	% of 8 – hour > 85 dBA	% time >85 dBA hearing protection	Average full – shift noise level (dBA)
<i>Sheet Metal Worker</i>	11%	66%	79.0
<i>Insulation Worker</i>	18%	14%	75.3
<i>Tilesetter</i>	20%	12%	76.0
<i>Electrician</i>	20%	18%	79.9
<i>Bricklayer</i>	26%	49%	82.6
<i>Masonry Restoration</i>	37%	56%	82.7
<i>Carpenter</i>	40%	43%	82.2
<i>Ironworker</i>	40%	13%	82.9
<i>Laborer</i>	44%	NA	83.6
<i>Cement Mason</i>	46%	8%	79.3
<i>Operating Engineer</i>	46%	70%	84.6

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Determine the Sources of Noise Pollution at Building Sites

Construction equipment and gadget operation, heavy equipment operation [7], vehicle transporting supplies, and loud voice communication were identified as four factors in this investigation. Heavy machinery working was found to be the most major source of noise

pollution at construction sites, with a mean of 8.46 and SD of 1.346. Construction equipment and device operation (mean = 7.84, SD= 1.342), vehicle hauling materials (mean=7.1, SD=1.856), and loud voice communication (mean=5.44, SD=1.88) are the next three categories. And according to majority of respondents, heavy machinery causes the most noise pollution at building sites, although



loud voice communication rarely adds to noise pollution because communication does not last long and does not spread far. The frequency and

proportion of elements that contribute to worksite noise pollution are shown in Table 7.

Table 7. Factors that Cause Noise Pollution at Construction Site: Frequency and Percentage

<i>Factors</i>	1	2	3	4	5	<i>Mean</i>	<i>SD</i>
<i>Operation construction equipment and device</i>	0	4 (3.3%)	20 (16.7%)	78 (65%)	18 (15%)	7.84	1.342
<i>Heavy machinery operating</i>	2 (1.7%)	0	4 (3.3%)	76 (63.3%)	38 (31.7%)	8.46	1.346
<i>Vehicle Transporting Materials</i>	2 (1.7%)	20 (16.7%)	18 (15%)	70 (58.3%)	10 (8.3%)	7.1	1.856
<i>Loud voice communication</i>	6 (5%)	50 (41.7%)	42 (35%)	16 (13.3%)	6 (5%)	5.44	1.88
<i>Overall</i>	-	-	-	-	-	7.208	0.984

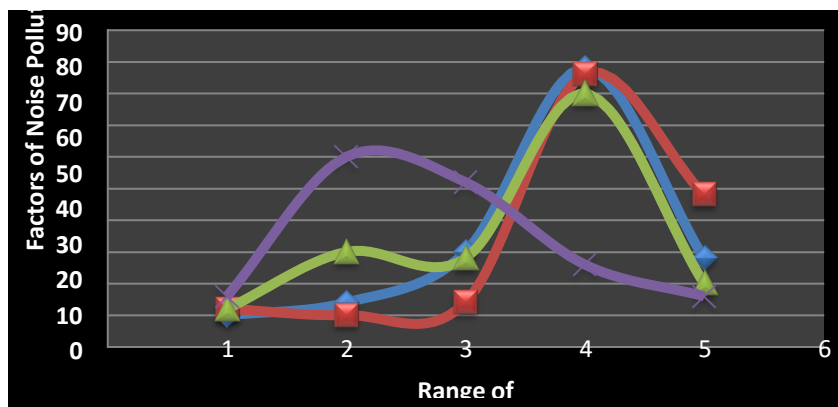


Figure 3. Factors and Range of Noise Pollution

Cardiovascular illnesses, overstress [8], irreversible hearing loss [3][15], the seven effects found are sleep disruption, loss of focus, misunderstanding of information, and abnormal blood flow and skin temperature. Table 8 indicates the frequency and frequency of noise pollution-related consequences at construction sites. Sleep disturbance (Mean=8.01, SD=1.35) was the most significant effect of noise pollution at construction sites, following by inability to focus (Mean=8.0, SD=1.276) and hearing problems (Mean= 7.96,

SD=1.302). Noise pollution at the construction site creates sleep disruptions for construction workers as well as nearby neighbours while construction is going on all day and night. Residents are unable to sleep owing to the high frequency noise from the construction site. The least significant effect of noise pollution on blood flow and body temperature (Mean=5.44). This is due to a lack of expertise and awareness within the workforce. Workers may consider more issues besides noise pollution when conditions develop.

Table 8. Noise Pollution at Construction Site: Frequency and Percentage of Effects



Effects	1 Strongly Not agree	2 Not agreed	3 Average	4 Agreed	5 Strongly agreed	Mean	SD
Cardiovascular Disease	6 (5%)	38(31.7%)	44(36.7%)	22(18.3%)	10(8.3%)	5.86	2.046
Over Stress	2 (1.7%)	2 (1.7%)	18 (15%)	82(68.3%)	16(13.3%)	7.8	1.412
Hearing Loss	0	4(3.3%)	14(11.7%)	82(68.3%)	20(16.7%)	7.96	1.302
Sleep disturbance	0	4(3.3%)	12(10%)	78(65%)	26(21.7%)	8.1	1.35
Unable to focus	0	4(3.3%)	12(10%)	84 (70%)	20(16.7%)	8	1.276
Miscommunication of misinterpret information	2	40(33.3%)	18(15%)	48(40%)	12(10%)	6.46	2.158
Change in blood circulation and body temperature	8(6.7%)	56(46.7%)	26(21.7%)	22(18.3%)	8(6.7%)	5.44	2.118
Overall	-	-	-	-	-	7.09	0.918

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Passive solutions, on the other hand, are often large when used for lower frequencies since their size and mass are often governed by the acoustic wavelength, making them larger for lower frequencies. In the industrial side of passive noise control applications, the noisy equipment or machine is enclosed by a material that attenuates the undesirable noise, which is periodic or nearly periodic because the noise source is the rotating portion of the machine. If the equipment is part of a manufacturing line, moving it is usually impossible.

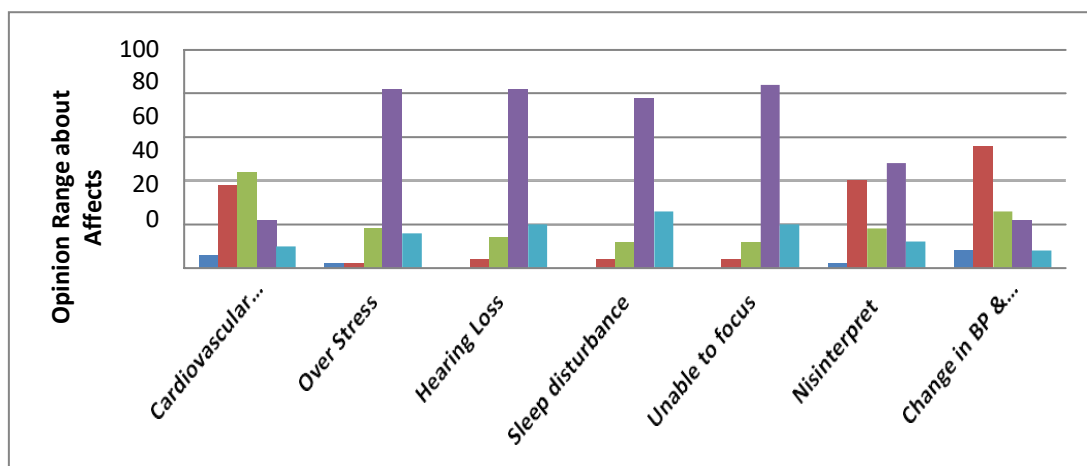


Figure 4. Frequency opinion about Noise Pollution at Construction Site



OSHA (Occupational Safety and Health Administration) safety precautions and preventive rules [11], and various EPA (Environmental Protection Agency) requirements, are just a few of the rules that exist. Detecting unusual noise and avoiding direct contact, as well as wearing protective gear when necessary. [9] In reality, any environmental assessment must take into account the mandatory Health & Security Standards.

4. Conclusion

Listen for the noise's key features to be measured (*temporal qualities, steady-state, intermittent/impulse qualities: frequency characteristics, wide band noise, predominant tones infrasound ultrasound, etc.*). Select the most appropriate instruments (sound level metre, noise dosimeter, filters, and so on) and set it up. Examine the calibration and functioning of the device (*batteries, calibration data, microphone corrections, etc.*). Make a drawing of the sound pressure levels to be assessed, including significant noise sources as well as the site's size and other key features. Measure the noise level for every weighting network or frequency band and make a note of it. Also take notice of the meter's reaction and the degree to which it varies. The hearing system and mental health of product construction employees are both studied in this paper. As a result, this continual monitoring and precautionary measures will be beneficial to the workers' lives. Construction contractors should comply with rules and complete noise assessment and audiometric testing as necessary, allowing for the adoption of suitable measures to address and verify the problem, according to the report. [4] Contractor associations must raise knowledge of noise, NIHL, and the influence on worker performance, as well as the essential mitigation methods. To guarantee that what happens on the job site is understood across the organisation, communication between the various levels of construction organisations must be strengthened.

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