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DETERMINATION OF NOISE EXPOSURE LEVEL AT CONSTRUCTION AREA

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The purpose of this study is to determine the noise exposure level among the workers that working in construction area. The study was carried out at construction sites and workshop. The data of noise level was collected by using Noise Dosimeter (SIE95) and analysed by dBTRAIT software. Result shows the maximum of noise dose (D) for Sri Gading and UTHM is approximately 43% and 28% respectively, while time weighted average noise level (TWA) for these sites is about 84 dB (A) and 80.8 dB (A) respectively. IKBN recorded maximum of noise dose (D) and average noise level (TWA) is 88 dB (A) and 75.8% respectively. The level of noise exposure at selected areas is in acceptable range based on regulation. As conclusion, workers who at the areas are advisable to wear hearing protection device when construction activities take place in order to civilize safety practice in the industry field.

Keywords: Noise exposure, construction area, TWA, noise dose

Scope: Engineering

1. INTRODUCTION

Noise in unwanted sound that may be unnoticed caused some psychological and physical stress to living as well as non living objects [1-2]. Construction activity is one of the sources of noise pollution besides road traffic, manufacturing processes etc. Levels of noise (TWA) for industrial area is recorded as 75dB (A) and 70dB (A) in day and night time respectively based on ambient noise standard [3]. Several studies were made and published regarding to sources and effects of noise [1-5]. It is clear that the construction worker will has hearing loss if they expose to very high noise levels for considerable lengths of time [4]. The permissible noise exposure for worker to receive is 90 dB(A) for 8 hour working hours; equivalent to 100% of noise exposure [6-7]. Table 1 lists the permissible noise exposure per day and while, Table 2 tabulates the noise dose per day based on the TWA dB (A). Due to the importance of this matter regarding to workers health, this study was undertaken to determine the noise exposure level among the workers that working in construction area.

Table 1. Permissible Noise Exposure [6]

Duration per day, hours	Noise Level dB (A) slow response
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

Table 2. Conversion from Noise Dose to 8 hours time weighted average noise level (TWA) [8]

Percentage Noise Exposure or Dose (%)	TWA dB (A)
25	80
50	85
100	90
200	95
400	100
800	105

2. METHODS AND DATA COLLECTION

2.1 Sampling

The study has been carried out at three different location; i.e Universiti Tun Hussein Onn Malaysia (UTHM), Institut Kemahiran Belia Negara (IKBN) Dusun Tua, Hulu Langat dan Sri Gading as shown in Figure 1.

(a) At Construction site in Universiti Tun Hussein Onn Malaysia (UTHM)

(b) At Construction site in Sri Gading

(c) At construction workshop in IKBN Dusun Tua

Fig 1. Locations of observation area

Data sampling at UTHM and Sri Gading as in Fig 1 (a) and (b) respectively were carried out during a day working hour or at least 8 hours per day within 2 months. During observation, data was recorded 4 times through workers that operate 4 selected machines as samples; i.e lorry, excavator, backhoe and back pusher that have been used in the construction site.

Meanwhile, observation of noise level that caused by hand tools; i.e grinder was carried out at construction workshop as shown in Fig 1 (c) within 2 months. 30 students were offered to involve in noise level measurent during 2 hours of laboratory activities. This finding will be compared to noise level that caused by machinery.

2.2 Noise Dosimeter

Noise levels were measured by using a Noise Dosimeter (SIE95) which is function to measure exposure level sound based on noise exposure regulation [6]. The dosimeter gives total noise dose to which worker has been exposed during the day. A 5 dB(A) exchange rate was used to calculate personal exposures. This was based on maximum exposure of 90 dB(A) over 8 hour working hours. This equipment was operated by using battery with size of 6F22 9V and microphone to catch sound. The calibration process was done for this apparatus by set one audible tone with accurate level and frequency which is 114 dB (A). The apparatus is worn by the worker for entire work day/shift. When the work shift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by:

$$D = 100\ (C_1/T_1) + (C_2/T_2) + \ldots\ldots\ldots + (C_n/T_n) \qquad (1)$$

Where, D = noise dose (%), C = actual time noise exposure and T = recommended exposure limit [6]. The eight hour time weighted average noise level (TWA) in decibels, may be computed from the dose, in percent, by this following formula:

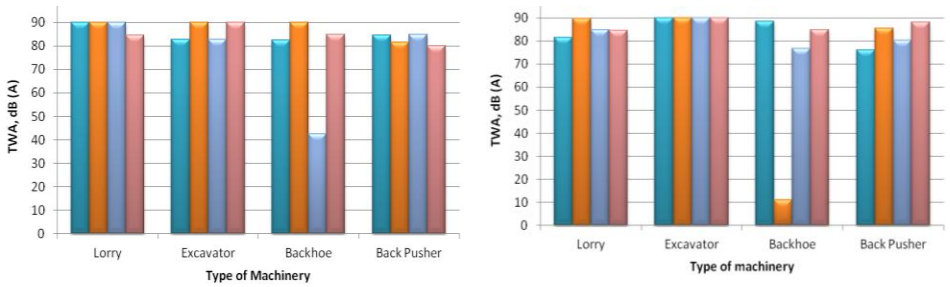
$$TWA = 16.61 \log_{10} (D/12.5T) + 90 \qquad (2)$$

For an eight hour workshift with the noise level constant over the entire shift, the TWA is equal to the measured sound level [6]. Data then was analysed by using dBTRAIT software to produce the output.

3. RESULT AND DISCUSSION

3.1 Time weighted average noise level (TWA)

It is necessary to compute value of TWA for these construction activities in determining the noise exposure received by the workers. Similarity has been noticed at both sites in Fig 3, which are almost 38% of samples yield TWA ± 90 dB (A) and backhoe contributes less among machinery.



(a) Sri Gading (b) UTHM

Fig 3 Time weighted average noise level (TWA) for four types of machinery at construction site in Sri Gading and UTHM

Fig 4 shows the time weighted average noise level (TWA) which is obtained from 30 students who are carried out their work project at construction workshop in IKBN, Hulu Langat. These hand tools activities were included in impulse noise because the occurrence is not continuously. The result shows the maximum and minimum of TWA is 88 dB (A) and 46 dB (A) respectively.

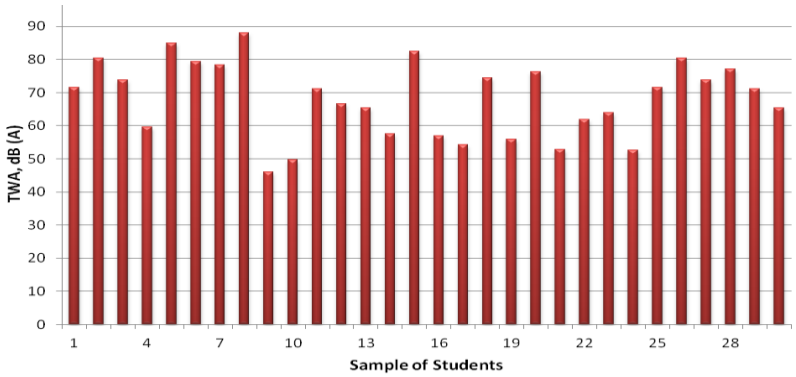
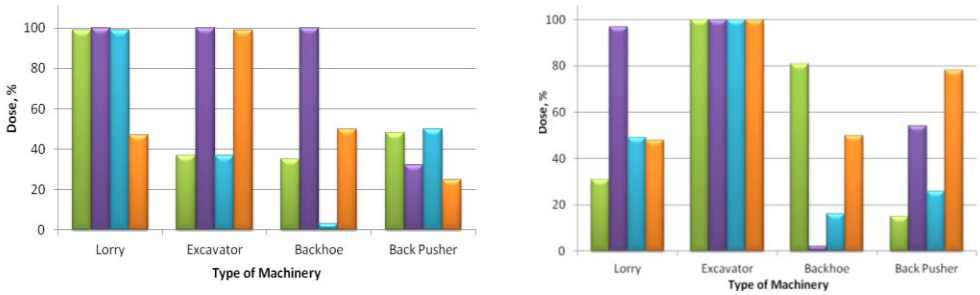


Fig 4. Time weighted average noise level (TWA) for 30 students at construction workshop in IKBN, Hulu Langat

3.3 Noise Dose

Noise dose is an important matter that needs to be figured out based on (TWA) for 8 hours per day as tabulated in Table 2. From Fig 5, almost 38% of samples obtained 100% of noise dose, where TWA have reached permissible noise exposure limit, is 90 dB (A). The dominant machinery contributor at the construction site in Sri Gading and UTHM is lorry and excavator respectively. While at IKBN as shown in Fig 6, the range of noise dose is from 0.2 to 75.8%. In addition, approximately 60% of workers (students) received noise dose below 10dB (A).



(a) Sri Gading (b) UTHM

Fig 5 Noise dose for four types of machinery at construction site in Sri Gading and UTHM

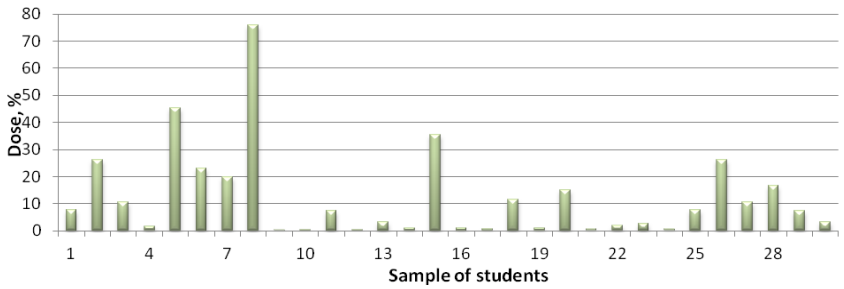


Fig 6 Noise dose for 30 students worked at construction workshop in IKBN, Hulu Langat

The average of TWA and noise dose for construction sites are tabulated in Table 3. Almost all workers received noise exposure less than 100% except workers that handling excavator machine. The backhoe and back pusher constributed minimal level of noise exposure.

Table 3. Average of TWA and noise dose for Construction Sites

Type of Machinery	Sri Gading		UTHM	
	TWA, dB(A)	Dose, %	TWA, dB(A)	Dose, %
Lorry	88.65	83	85.2	51
Excavator	88.97	87	90.15	100
Backhoe	75.08	13	65.26	5
Back Pusher	82.85	37	82.57	36

4. CONCLUSIONS

As conclusion, maximum of noise dose (D) for Sri Gading and UTHM is approximately 43% and 28% respectively, while time weighted average noise level (TWA) those site is about 84 dB (A) and 80.8 dB (A) respectively. Nevertheless, the

students from IKBN recorded maximum of noise dose (D) and average noise level (TWA) is 88 dB (A) and 75.8%. The level of noise exposure at selected areas is in acceptable range based on regulation and workers are in harmless stage. However, the usage of hearing protection device; i.e ear plug and ear muff shall be investigated through questionnaire to determine the awareness and hearing loss among workers for future understanding.

In addition, workers who at the construction areas are advisable to wear hearing protection device when construction activities take place because 20% of overexpose situations were reduced to levels below 85 dB(A) through the use of hearing protection device [5] and also to civilize safety practice in the industry field.

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