

## STUDY OF NOISE PRODUCED BY CONSTRUCTION ACTIVITIES IN ACADEMIC AREA

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### Article history

Received

27 April 2015

Received in revised form

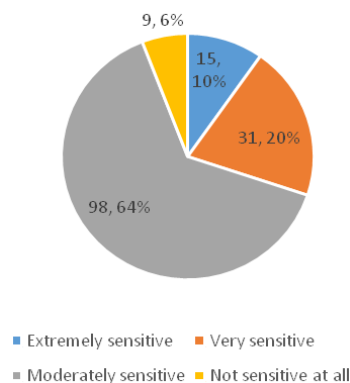
15 June 2015

Accepted

1 July 2015

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### Graphical abstract



### Abstract

Noise has been a problem since our country is a developing country. The noise pollution came from the traffic as well as the development of construction industry. In 2012, there was a case in Johor Bahru where a project has been delayed for months due to the residents in the area of the construction blocking the roads for lorries and other transports to pass through. This is because the residents were disturbed by the noise of piling activities. In this research, a study was made on the relationship of the noise level produced by the construction activities and the annoyance level in the academic area. The method used is by taking the reading of the noise level and the questionnaire method. The main purpose of the questionnaire method is to rate the annoyance level produced by the construction activities. As expected, most of the respondents were annoyed by the noise produced by the construction activities even though the reading of the noise level is not that high. From this result, we may conclude that even though the noise level produced by construction activities is not that high, it is still a disturbance for people in an academic area.

**Keywords:** Noise pollution, academic area, decibel, construction

### Abstrak

Bunyi telah menjadi masalah kronik kerana negara kita adalah sebuah negara yang sedang membangun. Pencemaran bunyi berpunca dari lalu lintas dan juga pembangunan industri pembinaan. Pada tahun 2012, terdapat satu kes di Johor Bahru di mana sebuah projek pembinaan telah ditangguhkan selama berbulan-bulan kerana para penduduk di kawasan pembinaan yang menyekat jalan-jalan untuk lori dan pengangkutan lain untuk melaluinya. Ini kerana para penduduk telah diganggu oleh masalah bunyi bising aktiviti cerucuk. Dalam kajian ini, satu kajian kes telah dibuat ke atas hubungan tahap bunyi bising yang dihasilkan oleh aktiviti pembinaan dan untuk menilai tahap kegusaran di kawasan akademik. Kaedah yang digunakan adalah dengan mengambil bacaan paras bunyi dan melalui boring soal selidik. Tujuan utama kaedah soal selidik ini adalah untuk menilai tahap gangguan yang dihasilkan oleh aktiviti pembinaan. Seperti yang dijangkakan, kebanyakan responden berasa terganggu dengan bunyi yang dihasilkan oleh aktiviti pembinaan walaupun bacaan paras bunyi yang tidak begitu tinggi. Daripada keputusan ini, kita boleh membuat kesimpulan bahawa walaupun tahap bunyi bising yang dihasilkan oleh aktiviti pembinaan adalah tidak begitu tinggi, ia masih merupakan gangguan bagi orang-orang di kawasan akademik.

**Kata kunci:** Pencemaran bunyi, kawasan akademik, decibel, pembinaan

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## 1.0 INTRODUCTION

In this 21<sup>st</sup> Century, we are facing a rapid economic development in this country. Construction industry also facing the same rapid development. As one of the result of the rapid development of construction industry, noise has become one of the problems and effects to the people. Other than construction industry, noise traffic also has become a major problem in the country.

There are bad effects of constantly hearing and listening to the noise. Based on relevant study on the effect of sound environmental factors on human body reactions, exposure to excessive different frequencies noise environment is likely to cause physiological symptoms, such as hearing loss, aprosexia, impatience, insomnia, indigestion and ischemic heart disease could result in a rise of blood pressure. And long-term under low-frequency noise environment stimulations, the physiological response of excitement degree of human autonomic nervous system and central nervous system could undergo significant changes.

Other than that, noise also does affect the academic performance to some people. According to the arousal theory ([1], exposure to moderate or high intensity noise causes an increase in arousal. Heightened arousal leads to a narrowing of an individual's attention. As a result, inputs that are irrelevant to task performance will be ignored first. As arousal increases, attention is further restricted; task-relevant cues may be ignored as well. The relationship between arousal level and task performance is represented as an inverted U-shaped function, known as the Yerkes-Dodson Law. Performance is greatest at a moderate arousal level and gradually tapers off as the arousal level either increases or decreases. Further, the effects of arousal on performance vary with task complexity. The optimal arousal level is lower for complex task than for simple ones.

## 2.0 LITERATURE REVIEW

Noise can be defined as unwanted sound or sound in the wrong place at the wrong time. Noise can also be defined as any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying [2]. The definition of noise as unwanted sound implies that it has as adverse effect on human beings and their environment, including land, structures and domestic animals. Noise can also disturb natural wildlife and ecological systems [2].

Acoustic noise can be defines as any undesired sound. According to this definition, a sound of Church bells may be musical to others. Usually, noise is a mixture of many tones combined in a non-musical manner [1]. What is pleasant to some ears may be extremely unpleasant to others, depending

on a number of psychological factors. The sweet music, if it disturbs a person who is trying to concentrate or to sleep, is a noise to him, just as the sound of pneumatic riveting hammer is noise to nearly everyone. In other words, and sound may be noise if circumstances cause it to be disturbing.

Other than that it is also a series or combination of loud, confused sounds, especially when causing disturbance. According to Wikipedia, noise is an unwanted sound. For example, conversations of other people may be called noise by people not involved in any of them; any unwanted sound such as domesticated dogs barking, neighbours playing loud music, portable mechanical saws, road traffic sounds, or a distant aircraft in quiet countryside, is called noise. In compliance to the specialists in acoustics opinion, noise is an unwanted sound that interferes with verbal communication and auditory perception of affects human behaviour, can reach to affect human health and activities [3]. So basically, noise is a sound that is not likely to be heard by people. It is the sound that people find disturbance by hearing it. Construction activities produce a lot of noise, the unwanted sound that may be disturbance to people. Noise is measured in a unit termed the A-weighted decibel, written dBA.

The decibel is a standard unit accepted for measuring sound levels cause to the fact that may be associated to large variations in sound pressure amplitude. When describing sound and its effect on human bodies, it is recommended to use sound levels "weighted A" – dB(A) in order to assess the response of the human ear. The term refers to a sound filtration in an appropriate manner by which the human ear perceives. The discomfort degree depends on the ambient noise level, the general nature of existing conditions (quiet/crowded areas, rural/urban areas), differences between event magnitude noise level and ambient noise conditions, sound event duration, season (open/closed windows, inside/outside activities), frequency and repeatability of noise event, time of day of producing it. Appropriate sound level scale, corresponding to national noise regulations, connects typical sound pressure levels and limits legally established Construction is the process of preparing for and forming buildings and building systems.

Construction starts with planning, design, and financing and continues until the structure is ready for occupancy. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager, design engineer, construction engineer or project architect. For the successful execution of a project, effective planning is essential. Those involved with the design and execution of the infrastructure in question must consider the zoning requirements, the environmental impact of the job, the successful scheduling, budgeting, construction site safety, availability and transportation of building materials, logistics,

inconvenience to the public caused by construction delays and bidding, etc.

Building construction is the process of adding structure to real property or construction of buildings. The vast majority of building construction jobs are small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as labourer, paymaster, and design team for the entire project. However, all building construction projects include some elements in common – design, financial, estimating and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation. For this reason, those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome. [4]. Table 1 list construction works with noise potential.

**Table 1** Types of construction work with noise potential [4]

Types of Construction Work	Contents of Construction Work
Carpentry	Construction of works by processing or applying wooden materials or application of wooden structures to work
Stone work	Processing of stone materials and production of stone works using masonry or by attaching stone to work
Roof work	Roof-cladding with tiles, slate, or metal sheet
Piping work	Work for installation of coolers, air conditioners, water supplies, hygiene facilities
Steel reinforcement work	Processing, connecting, and assembly of steel bars and other steel materials
Paving work	Paving streets and other flat surfaces with asphalt, concrete, sand, gravel, or rubble
Sheet metal work	Attaching metal sheet to structures or attaching metal sheet fixtures to structures
Well drilling work	Hole and well drilling using well drilling machinery and subsequent water pumping facilities work
Fittings work	Attachment of wooden or metal fittings to structures

### 3.0 METHODOLOGY

#### 3.1 Measurement of Noise Level

The measurement of noise level is taken using a Sound Meter Level. In order to take measurement of the noise produced by the construction activities, there must be noise. We have to know when the contractor will use a machine that will produce noise. The noise produced will be a disturbance to people surroundings. The measurement is taken depending on the distance, time and machine used in the construction site. The data will be collected based

on the readings of the noise level in dBA. After the data is collected, the data will be examined and analyzed in a table or graph. Below is the picture of sound meter level instrument. And below the pictures are examples of tabulation of data.

#### 3.2 Measurement of Temperature, Humidity and Wind Speed

Temperature, humidity and wind speed might affect the result of sound level measurement. By taking the measurement of temperature, humidity and wind speed, we can relate the relationship between sound level and temperature, sound level and humidity and sound level and wind speed. The measurement of temperature, humidity and wind speed is taken each time the sound level measurement is taken. The tool that is used to take these three measurements is Thermo Hygro 3 in 1 Anemometer. The Thermo Hygro 3 in 1 Anemometer can be used to take the reading of temperature, humidity and wind speed at one time.

#### 3.2 Questionnaire Method

Questionnaires were distributed to respondents which are among the students, lecturers and staffs in Universiti Sains Malaysia (USM). The purpose of the questionnaire is to study the level of nuisance caused by the construction activities nearby the academic area. The questionnaire is divided to three parts. The first part is about the respondents' background. Basically the questions are age, gender, education background and how familiar the respondents are towards construction noise. The second part is about the noise annoyance. The third part is about the respondents' opinions.

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Reading of Temperature, Wind Speed, Humidity and Noise Level

Table 2 shows the average reading of temperature, wind speed and noise level from Monday to Friday. Based on this table, the lowest reading of noise level is 52.29 dBA and the highest reading of noise level is 61.00 dBA. From this reading we can say that the noise from the construction activities is not that high to the extent that it will damage the hearing problem to the listener. It is still under the permitted decibel limit.

**Table 2** Average reading of temperature, wind speed and noise level from Monday to Friday

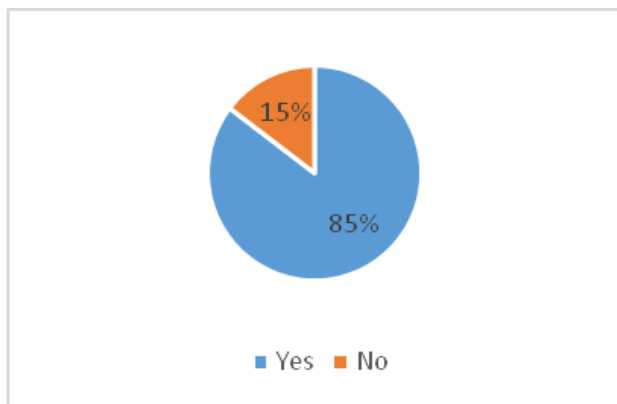
Day/Distance	Temp (°C)	Wind Speed (m/s)	30 ft	40 ft	50 ft	60 ft	70 ft	80 ft
Mon	32.41	0.47	55.68	54.41	55.71	52.29	54.52	55.94
Tues	32.21	0.68	59.68	58.89	58.83	57.6	59.04	55.73
Wed	33.04	0.47	59.21	59.08	59.16	58.88	59.04	57.01
Thurs	32.41	0.74	61.00	60.63	59.73	60.14	55.44	57.00
Fri	32.96	0.55	58.04	57.03	58.08	57.35	55.77	56.82

**4.2 Data Collected from Respondents**

These are the data collected from the questionnaires that have been distributed to respondents. The total number of respondents for this research is 155. Total questions for this set of questionnaire are 24 questions. In this part, analysis is only done for four main questions.

**4.2.1 Do You Find Noise from the Construction Site is Annoying and Disturbing?**

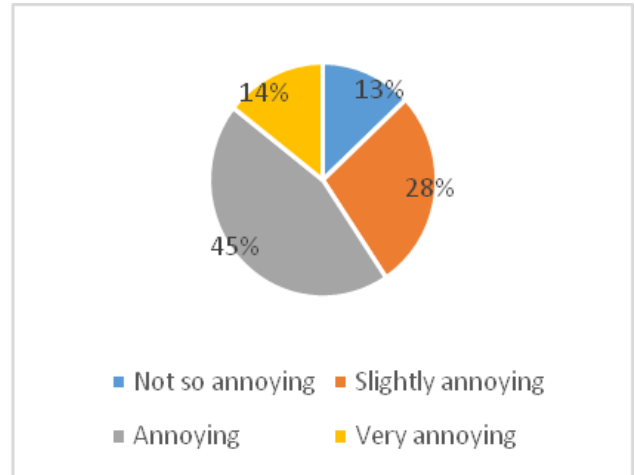
From the pie chart above (Figure 1), 85% of the respondents find the noise from the construction site is annoying and disturbing. While only the rest of the respondents which are 15% of them are not annoyed and disturbed by the noise from the construction site. Some of the respondents that are not annoyed and disturbed by the noise is due the immune of the noise because some of them are familiar with construction noise either they had been working in the construction site or they had been in the construction are for a while.



**Figure 1** Do you find noise from the construction site is annoying and disturbing?

**4.2.2 If Yes, Can You Please Rate the Annoyance Level?**

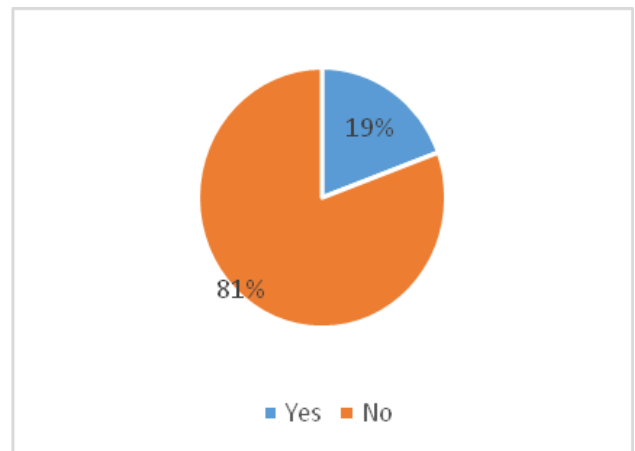
From Figure 2, the least respondents said they are not so annoyed by the construction noise. While 14% of them are very annoyed, 28% of them are slightly annoyed and majority of them which are 45% are annoyed with the construction noise. From this we can see that the construction noise really a disturbance and annoyance to people surrounding.



**Figure 2** If yes, can you please rate the annoyance level?

**4.2.3 Do You Think You Can Focus on Your Work With This Kind of Noise?**

From the pie chart (Figure 3), most of them which are 81% of them cannot focus in doing their work while hearing the construction noise. Only 19% of them can focus on their work while hearing the construction noise. From this data we can say that the construction noise is really a disturbance and annoyance to people in academic area.



**Figure 3** Do you think you can focus on your work with this kind of noise?

#### 4.2.4 How Sensitive to Noise are You in General?

From this pie chart (Figure 4), 64% of the respondents which are 98 out of 153 people are moderately sensitive to noise. Followed by 20% of the respondents are very sensitive to noise and 10% of the respondents are extremely sensitive to noise. Only 6% of the respondents are not sensitive at all to noise. Based on this data, the total percentage of respondents who are sensitive to noise are 94% which are very high. Most of the respondents are sensitive to noise which makes them feel uneasy with the construction noise produced in the academic area.

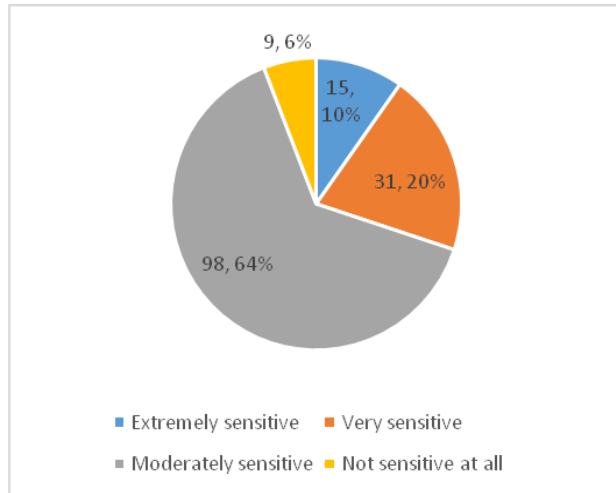


Figure 4 How sensitive to noise are you in general?

## 5.0 CONCLUSION

From this study, based on the first data collected, construction noise may not be that harmful to people surrounding the construction area. The noise reading level taken showed that it was not dangerous to the people to the extent that it will harm people's health. However, based on the data collected from the questionnaire, we can conclude that the people in an academic area are annoyed with construction noise. It is recognized that a new noise control requirement maybe needed for construction activities held in an academic area.

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