Survey of Ambient Noise in Barangay Bitoon, Jaro Iloilo City

RESEARCH STUDY

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ABSTRACT

Noise can be recognized as a serious health hazard and the health effects of the hazardous noise exposure are now considered to be an increasingly important communal health problem. That is why noise surveys are conducted in order to inform population centers the risk of excessive noise exposure. In the area of Barangay Bitoon, there was no record of noise survey conducted.

This study determines environmental noise levels present in different regions of Bitoon, Jaro Iloilo City. Specifically, it is to measure the mean ambient noise levels (in dBA) in three areas of Barangay Bitoon, Jaro Iloilo City namely the public market, the karaoke television bar, and along the coastal road daily for one week.

A one week survey is conducted in the three sites. In each location, the researchers recorded the ambient noise for 5 times at intervals of 3 minutes for 30 minutes starting at 6:30am, 6:00pm, and 8:00pm.

It was found out that Bitoon Marketplace had the lowest sound pressure level with 64.7 dBA, Coastal roadside ranked second with 70.7 dBA, and KTV Bar yielded the highest sound pressure level at 85.8 dBA. According to International Health Standards, constant exposure to noise that are of same levels with that of KTV Bar beyond 47.5 minutes will result in hearing impairments. This study suggests that people who frequent this area should avoid staying long period of time.

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CHAPTER I

INTRODUCTION

A. Background of the Study

Noise is derived from the Latin word "nausea" implying 'unwanted sound'. The noise originates from human activities, especially 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. Noise is becoming an increasingly present, yet unnoticed form of pollution even in developed countries. Noise pollution is an unseen and unaddressed problem in all population centers. It is excess noise that hinders and disrupts the productivity of citizens (Singh and Davar 2004).

Noise can be recognized as a serious health hazard and the health effects of the hazardous noise exposure are now considered to be an increasingly important communal health problem. The direct health effect known to be attributable to noise is hearing loss with noise exposure higher than 90 decibels. Long durations of exposure to noise also can interfere with communication, disturb sleep, cause cardiovascular and psycho-physiological effects, reduce performance, and provoke annoyance responses and changes in social behavior. The main social consequence of hearing impairment is the inability to understand speech in normal conditions, which is considered a severe social handicap (Basrur 2000)

B. Statement of the Problem

This study determined the environmental noise levels present in different regions of Bitoon, Jaro Iloilo City.

C. Objectives of the Study

To measure the mean ambient noise levels (in dBA) in three areas of Barangay Bitoon, Jaro Iloilo City namely the public market, the karaoke television bar, and along the coastal road daily for one week.

D. Significance of the Study

The significance of the study is to help the inhabitants of Bitoon to be aware of the noise levels in their surroundings. The measurements taken was compared to standards specified by the World Health Organization in order to check if the noise levels within the town are up to international requirements.

E. Scope and Delimitation

This study was limited to the district of Brgy. Bitoon, Jaro Iloilo City and in the surrounding immediate area. Due to the inaccessibility of specialized equipment for measuring noise, the researchers improvised using the Digital-Display Sound-Level

Meter that was mounted on a tripod and placed 1m away from the façade of the testing area.

F. Definition of Terms

Sound Pressure Level

-Sound pressure is the local pressure deviation from the ambient (average or equilibrium) pressure caused by a sound wave. Sound pressure can be measured using an oscillator or decibel reader. The SI unit for sound pressure is the pascal (Pa).

Noise Levels Table

-The noise level tables represent the allowable exposure durations for various exposure levels according to different organizations.

Threshold of Pain

-In hearing, the threshold of pain is the sound pressure or sound pressure level beyond which sound becomes unbearable for a human listener.

Threshold of Hearing

-The minimum intensity audible to the human ear (1.0×10^{-12} W/m^2).

Reverberation Rate

- An oscillatory effect seen on seismic wave-forms and produced by short-path multiples or in simpler terms, the bouncing back of sound waves.

CHAPTER II

REVIEW OF RELATED LITERATURE

A. Sound Pressure Level

The sound pressure level, in decibel is ten times the logarithm of the ratio of the time-mean-square pressure of a sound, in a stated frequency band or with a stated frequency weighting, to the square of the reference sound pressure of $20x10^{-6}$Pa (www.diracdelta.co.uk). We can calculate the sound pressure level using the equation:

$$L_p = 10 \log_{10} \left(\frac{p_{\text{rms}}^2}{p_{\text{ref}}^2} \right) = 20 \log_{10} \left(\frac{p_{\text{rms}}}{p_{\text{ref}}} \right) \text{ dB},$$

The sound pressure level of an object is measured using the decibel reader. Sound intensity level and sound pressure level are equal in terms of units and value but differ on the process on how to calculate. (wikipedia.com)

B. Sound Intensity

The intensity of the wave is defined as the energy transported by a wave per time unit across a unit area. It is proportional to the square of the wave amplitude -measured in watts/meter^2 (W/m^2) (Giancoli 1995).

Sound intensity, I is calculated using the formula: β (in dB) = 10 log I / I_o, where I_o is the "threshold of hearing" (the minimum intensity audible to the human ear), which

is $I_o = 1.0 \times 10^{-12}$ W/m^2 and β is the sound pressure level (explained above). Sound intensity can also be derived from the sound pressure level which is measured using the decibel reader / oscillator (Giancoli 1995).

C. Noise Level Standards

The noise level tables represent the allowable exposure durations for various exposure levels according to the World Health Organization (WHO), Occupational Safety and Health Administration Permissible Exposure Limit (OSHA PEL), National Institute for Occupational Safety and Health Recommended Exposure Limit (NIOSH REL), Environmental Protection Agency (EPA) standards (Gershon et al 2006).

Allowable daily exposure durations for various exposure levels.

	EXPOSURE DURATION LIMIT (min)					
	75 dBA	85 dBA	90 dBA	100 dBA	105 dBA	115 dBA
OSHA PEL	Unlimited	960	480	120	60	15
NIOSH REL	Unlimited	480	151	15	45	0.5
EPA/WHO	480	47.5	15	1.5	0.5	0

The table , below, shows the permissible noise exposures (WHO) that require hearing protection for employees exposed to occupational noise at specific decibel levels for specific time periods. Noises are considered continuous if the interval between occurrences of the maximum noise level is one second or less. Noises not meeting this definition are considered impact or impulse noises (loud momentary explosions of sound)

and exposures to this type of noise must not exceed 140 dB. Examples of situations or tools that may result in impact or impulse noises are powder-actuated nail guns, a punch press or drop hammers.

Permissible Daily Noise Exposure Levels	
Exposure Level (dB)	Exposure Duration Limit (*min*)
> 120	0
110 - 120	0.5
100 - 110	1.5
90 - 100	15
80 - 90	47.5
70 - 80	480
< 70	Unlimited

D.Noise Health Effects

Noise can be recognized as a serious health hazard and the health effects of the hazardous noise exposure are now considered to be an increasingly important communal health problem. The direct health effect known to be attributable to noise is hearing loss with noise exposure higher than 90 decibels. Long durations of exposure to noise also can interfere with communication, disturb sleep, cause cardiovascular and psycho-physiological effects, reduce performance, and provoke annoyance responses and changes in social behavior. The main social consequence of hearing impairment is the inability to understand speech in normal conditions, which is considered a severe social handicap (Basrur 2000)

E. Sources of Noise

Noise is derived from the Latin word "nausea" implying 'unwanted sound' or 'sound that is loud, unpleasant or unexpected'. The noise originates from human activities, especially the urbanization and the development of transport and industry. Though, the urban population is more affected by such pollution, small town/villages along side roads or industries are also victim of this problem (Singh 2004).

Noise is becoming an increasingly present, yet unnoticed form of pollution even in developed countries. Sources of noise pollution include inter alia, vehicular traffic, neighborhood, electrical appliances, TV and music system, public address systems, railway and air traffic, and generating sets. Most of the people inhabiting metropolitan cities or big towns and those working in factories are susceptible to the adverse effects of noise. The problem of noise pollution is less in small towns and villages. But, those residing in villages/ towns along the national/ state highways or close to railway tracks do bear the burnt of excessive noise (Singh 2004).

F. Factors That Affect Noise

Curves have been drawn showing the effect of water vapor, temperature and air on the total sound propagation within the surroundings. At 4096 cycles changes in barometric pressure seem to have an appreciable effect (Chrisler et al. 1932).

G. Threshold of Pain

In hearing, the threshold of pain is the sound pressure or sound pressure level beyond which sound becomes unbearable for a human listener. This threshold varies only slightly with frequency (Giancoli 1995).

Prolonged exposure to sound intensity levels in excess of the threshold of pain can cause physical damage, potentially leading to hearing impairment (Giancoli 1995).

H. Noise Level Surveys

Excessive noise exposure is a serious global urban health problem, adversely affecting millions of people. Noise control measures are being considered as part of an overall strategy to help improve the quality of life of urban dwellers (Gershon et al 2006).

Noise survey are conducted to establish existing background noise level enjoyed by residential properties and to assess the proposed changes in relation to the noise levels taken (Roberts 2008).

In measuring the noise pressure level, the measuring device must be mounted using a tripod in front of testing sites and at least 1m from the façade. Each measurement must last for twenty minutes (Issarayangyun et al 2005).

The results are then compared whether they are in line based on the fixed standards established by the World Health Organization, National Institute for Occupational Safety and Health Recommended Exposure Limit, Occupational Safety and Health Administration Permissible Exposure Limit (Gershon et al 2006).

I. Digital-Display Sound-Level Meter

The Digital-Display Sound-Level Meter gets precise readings when you fine-tune audio response of a stereo, PA or home theater system in combination with an equalizer. It measures A or C weighted sound levels, has slow and fast response times, and the meter can analyze and output the maximum, minimum and integrated average measurements in an area. Specifications include an electret condenser microphone that measures in a 50 to 126 dB range and with an accuracy of ±2 dB at 114 dB SPL. The meter can operate at a temperature level within 32 to 122 °F (0 to 50 °C) and can be stored within -40 to 149 °F (-40 to 65 °C). The dimensions (height, length, width) of the apparatus are 6¼ × 2½ × 1¾ Inch (159 × 64 × 44 mm) and it weighs about 6.7 oz (190 g) including the 9v alkaline battery (radioshack.com 2008).

J. A Weighted Decibels

A-weighted decibels, abbreviated dBA, or dBa, or dB(a), are an expression of the relative loudness of sounds in air as perceived by the human ear. A-weighting has A-curve frequency characteristics and causes the meter to respond mainly to frequencies ranging from 500 to 10,000 Hz. This. In the A-weighted system, the decibel values of sounds at low frequencies are reduced, compared with unweighted decibels, in which no correction is made for audio frequency (radioshack.com 2008).

In computer systems, dBA is often used to specify the loudness of the fan used to cool the microprocessor and associated components. Typical dBA ratings are in the neighborhood of 25 dBA, representing 25 A-weighted decibels above the threshold of hearing. This is approximately the loudness of a person whispering in a quiet room (whatis.com 2005).

K. Noise Level Classification

	Painful& Dangerous: Use hearing protection or avoid
140	Fireworks..
	Gun shots..
130	Custom car stereos (at full ..volume)
	Jackhammers..
	Ambulances..
	Uncomfortable: Dangerous over 30 seconds
120	Jet planes (during take off)..
	Very Loud:Dangerous over 30 minutes
110	Concerts (any genre of music)..
	Car horns..
100	Sporting events..
	Snowmobiles..
90	MP3 players (at full volume)..
	Lawnmowers..
	Power tools..
	Blenders..
	Hair dryers..
	Over 85 dBfor extended periods can cause permanent hearing loss.
	Loud
80	Alarm clocks..
70	Traffic..
	Vacuums..
	Moderate
60	Normal conversation..
	Dishwashers..
50	Moderate rainfall..
	Soft
40	Quiet library..
30	Whisper..
	Faint
20	Leaves rustling..

The table above shows the classification of noise levels. As shown, there are seven classes namely, faint, soft, moderate, loud, very loud, uncomfortable, and painful and dangerous (American Academy of Audiology 2010).

CHAPTER III

METHODOLOGY

A. Materials

Digital-Display Sound-Level Reader

Tripod

B. Sampling Plan

The study was conducted over a period of one weeks, one week dedicated to three testing sites namely, the market, the karaoke television bar, and along the coastal road. Measurements were taken every day at 6:30am, 8:00pm, and 6:00pm respectively.

C.Measuring the Range of Ambient Noise Levels

Before the researchers measure the ambient noise levels, they will start the measurement in real-time (dBA/sec) starting at the 120 dBA (+/- 10) range. If LO is displayed in the digital sound level meter, the researchers will measure at the next range 10dBA lower until they get a valid reading.

D. *Measuring of Ambient Noise Levels*

In each location namely, Bitoon Marketplace, along the coastal road and the KTV Bar, the researchers recorded the ambient noise for 5 times at intervals of 3 minutes for 30 minutes starting at 6:30am, 6:00pm, and 8:00pm. At each location, the decibel meter was mounted using a tripod in front the façade of each testing site to reduce reverberation rate.

The sound files were then analyzed by the decibel reader and the maximum and minimum reading is taken. The Sound Pressure Level of the testing site was then averaged to produce the average SPL of that area.

CHAPTER IV

RESULTS & DISCUSSION

This study aims to determine the environmental noise levels in different areas of Bitoon, Jaro Iloilo City. Specifically, it aims to determine the average ambient noise levels (in dB) in three areas of Barangay Bitoon, Jaro Iloilo City namely the public market, the karaoke television bar, and along the coastal road at 6:30am, 8:00pm, 6:00pm, respectively.

A. RESULTS

The result of the noise survey showed that in Barangay Bito-on, the location that has the highest mean sound pressure level is around KTV Bar followed by the along the Coastal Road, while the Marketplace has the lowest noise level. (Table 1)

Table 1. Average sound pressure level of selected locations in the area of Barangay Bito-on.

	Mean Sound Pressure Level
MARKETPLACE	64.7 dBA
COASTAL ROAD	70.7 dBA
KTV BAR	85.8 dBA
Note: The marketplace readings were taken at 6:30 am. The coastal road at 6:00 pm and the KTV bar at 8:00 pm.	

B. DISCUSSION

The KTV bar showed the highest average sound pressure level at 85.8 dBA. The Coastal Road ranked second in terms of loudness at 70.7 dBA. And finally, the Marketplace had the lowest sound pressure level at 64.7 dBA.

Table 2. Allowable daily exposure durations for various exposure levels.

Exposure Level (dB)	Exposure Duration Limit (min)
> 120	0
110 - 120	0.5
100 - 110	1.5
90 - 100	15
80 - 90	47.5
70 - 80	480
< 70	Unlimited

Based on the noise level tables according to World Health Organization (WHO) standards, the sound pressure levels near the KTV Bar lie within the range of sound pressure levels that are greater than 75 dBA and less than 85dBA while the sound pressure levels of the marketplace and the area along the coastal roadside lie within the range of sound pressure levels greater than 0dBA and less than 75dBA. The maximum allowable daily exposure durations near the KTV Bar and the coastal roadside would be 47.5 minutes and 480 minutes respectvely, while for the marketplace there would be unlimited exposure (Gershon et al 2006).

The environmental noise levels in the three areas of Barangay Bitoon ranges from 60 dB to 90 dB. According to the American Academy of Audiology (2010), environmental noise levels that are greater than 50 dB and less than 70 dB, such as those in Bitoon Marketplace, are classified as Moderate Noise. The noise levels that are greater than 70 dB and less than 80 dB, such as those in Coastal Roadside, are classified as Loud Noise and noise levels that are greater than 80 dB and less than 110 dB, such as those in KTV Bare, are classified as Very Loud Noise

Longer exposure to the KTV Bar than the maximum allowable exposure durations would have a temporary effect such as hearing impairment while regular overexposure will cause permanent hearing damage (Basrur 2000).

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

A. Summary of Findings

1. The KTV bar, Coastal Roadside, and Bitoon Marketplace, was found to have a mean sound pressure level of 85.8 dBA, 70.7 dBA, and 64.7 dBA, respectively.

B. Conclusion

The environmental noise levels that are present in Barangay Bitoon ranges from Moderate Noise to Very Loud Noise.

C. Recommendation

The researchers further recommend that more studies that include more sampling sites and longer sampling durations should be conducted to create an improved model of the area.

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APPENDIX A

RAW DATA

August 31	september 1	September 2	September 3	September 4
Market				
60-80	50-70	50-70		
61,low,79	58,low,high	57,low,high		
63,low,72	61,low,high	57,low,high		
62,low,high	55,low,high	55,low,high		
62,low,high	58,low,high	63,low,high		
61,low,73	58,low,high	56,low,high		
Road				
60-80	60-80		60-80	60-80
70,low,high	65,low,78		70,low,high	72,low,high
72,low,high	73,low,high		68,low,high	73,low,high
72,low,high	77,60,high		70,low,high	70,low,high
71,low,high	74,low,high		69,low,high	71,low,high
72,low,high	75,63,high		69,low,high	74,low,high
Ktv				
80-100	80-100		60-80	80-100
87,low,98	86,low,98		68,low,71	89,low,93
85,low,96	86,low,high		65,low,68	86,low,high
81,low,99	81,low,97		65,low,75	87,low,high
84,low,high	87,low,99		73,low,high	91,low,97
89,low,95	88,low,high		77,low,high	93,low,99

September 5	september 6	September 9	September 17	September 18
Market				
60-80	60-80		50-70	60-80
69,low,78	76,low,high		63,58,high	68,low,high
63,low,72	79,65,high		62,56,high	66,low,80
73,low,high	79,63,high		62,60,high	70,low,high
70,low,high	77,60,high		63,58,high	70,low,high
65,low,74	71,low,77		65,59,high	67,low,77
Road				
	60-80	60-80		
	71,low,high	73,low,high		
	65,low,77	70,low,high		
	73,low,high	71,low,79		
	72,low,high	72,low,high		
	66,low,high	69,low,77		
Ktv				
		80-100		
		97,87,high		
		91,low,high		
		92,low,high		
		96,low,high		
		98,80,high		

September 19	September 20			
Ktv bar				
80-100	80-100			
86,low,high	87,low,100			
85,low,high	85,low,high			
87,low,high	90,low,high			
90,low,high	91,low,high			
90,low,high	90,low,high			
Road				
60-80				
72,low,77				
71,low,high				
68,low,75				
69,low,high				
66,low,high				

APPENDIX B

PICTORIALS

Plate 1. Bito-on Marketplace

Plate 2. Coastal Roadside

Plate 3. KTV Bar