

Salud Profesional

Artículo de Investigación

Acoustic pollution and its incidence in population health along Alejo Lascano Avenue in Jipijapa city – Ecuador

Contaminación sonora y su incidencia en la salud de los habitantes en la avenida Alejo Lascano de la ciudad de Jipijapa – Ecuador

Poluição sonora e sua incidência na saúde dos habitantes da Avenida Alejo Lascano, na cidade de Jipijapa - Equador

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Abstract

This research entitled: "Acoustic pollution and its incidence in population health along Alejo Lascano Avenue in Jipijapa city - Ecuador." The methodology that was used basically was the one of previous observation, the application of different instruments that were used beside tabulation and interpretation of results. Surveys were carried out to determine the knowledge of population about noise pollution and possible effects that this causes in daily life. Monitoring was carried out to measure the decibels caused by noise, they were put through in three different points, in a period of two months (August and September), on working days (Monday and Tuesday) and non-working days (Saturday and Sunday), rush hours in the morning (08H00-08H30), noon (12H00-12H30) and afternoon (17H00-17H30). The highest level of noise in August was presented at midday (12H00-12H30) on Monday 7 at point 1 of Alejo Lascano Ave. Km.1 Puerto Cayo road with a maximum average of 102.5 decibels dB (A) in September the highest noise level was at the same time on Tuesday the 11th at point 2 a maximum average of 103.7 decibels dB (A) was given, these values being higher than permissible in Ecuador, recommended by the TULSMA that is 55 decibels dB (A). Through surveys it was established the possible damages caused by noise pollution in Alejo Lascano Avenue Km.1 Puerto Cayo road in Jipijapa city with physiological and psychological effects. The environmental impact caused by noise is high, causing harmful effects on population such as possible hearing loss, headaches, nervous system alterations, stress that harm human health.

Key words: Sound Pollution; Health; Jipijapa City.

Resumen

Esta investigación titulada: "Contaminación sonora y su incidencia en la salud de los habitantes en la avenida Alejo Lascano de la ciudad de Jipijapa - Ecuador". La metodología que se utilizó básicamente fue la de observación previa, la aplicación de los distintos instrumentos que se utilizaron y la tabulación e interpretación de los resultados que se obtuvieron. Se realizaron encuestas para determinar el conocimiento de la población sobre la contaminación sonora y sobre las posibles afectaciones que esta causa en la vida cotidiana. Se realizaron monitoreos en tres puntos diferentes para medir los decibelios que ocasiona, en un periodo de dos meses (agosto y septiembre), en días laborables (lunes y martes) y días no laborables (sábado y domingo) en horas pico en la mañana

(08H00-08H30), medio día (12H00-12H30) y tarde (17H00-17H30). El mayor nivel de ruido en el mes de agosto se presentó en horario del medio día (12H00-12H30) el día lunes 7 en el punto 1 de la avenida Alejo Lascano Km.1 vía a Puerto Cayo con un promedio máximo de 102,5 decibelios dB(A) y en el mes de septiembre el mayor del nivel de ruido fue en el mismo horario el día martes 11 en el punto 2 se dio un promedio máximo de 103,7 decibelios dB (A), siendo estos valores superiores al permisible en el Ecuador, recomendado por el TULSMA que es de 55 decibelios dB(A). Por medio de encuestas se estableció los posibles daños ocasionados por el ruido que genera la contaminación sonora de la avenida Alejo Lascano Km.1 vía a Puerto Cayo de la ciudad de Jipijapa con efectos fisiológicos y psicológicos. El impacto ambiental que origina el ruido es alto causando efectos nocivos para la población como posible pérdida de audición, dolores de cabeza, alteraciones al sistema nervioso, estrés que perjudica la salud del hombre.

Palabras claves: Contaminación Sonora; Salud; Ciudad de Jipijapa.

Introducción.

Through a study, Ecuador ranks sixth in Latin America in relation to noise pollution disturbing the different community activities, interfering with spoken communication, the basis of human coexistence, disturbing sleep, rest and relaxation, inhibiting concentration and learning, and even more serious, creating states of fatigue and tension that can degenerate into nervous and cardiovascular diseases " (Luis Landa, 2013).

Sound pollution in Manabi advances according to population growth, airports, hospitals, vehicles, schools and other groups, considering Manabi one of the noisiest provinces in the country. In this canton the inhabitants have had to bear up to 110 decibels, when the allowed level in the country is 55 decibels categorized by the TULSMA (Andrea Rivera, 2018).

This research project refers to a study of the "Sound pollution and its impact on inhabitants health along Alejo Lascano Avenue in Jipijapa city - Ecuador". Jipijapa is a canton that has been evolving little by little, but noise pollution is increasing every day where the most affected is the population that have health problems due to the great noise of vehicles, discos, workshops, etc ... contaminating the environment.

The Alejo Lascano Avenue Km.1 Puerto Cayo road in Jipijapa city is an important source of noise pollution caused mostly by the different vehicles that pass through this avenue, causing health problems to inhabitants who live nearby. This investigation corresponds to the mixed residential area that mainly comprises residential use but commercial activities are presented and their sound pressure level, expressed in decibels, may not exceed the permissible values of noise in the environment decreed in chapter VI annex 5 of the Unified Text of the Secondary Legislation of Ministry of Environment (TULSMA), where according to the established zone the permissible limit of the place under study; is 55 decibels dB (A) according to the zone according to its ground use.

Theoretical framework.

Sound pollution

This term refers to noise when it is considered as a pollutant, that is an annoying sound that can produce physiological and psychological harmful effects to a person or group of people; it is said that one of the main causes of noise pollution is human activity, transport, construction of buildings and public works, industry, among others.

Sound pollution or also called acoustic pollution; it is defined as the presence of noise or vibrations in the environment, whatever the acoustic emitter that originates them, that imply discomfort, risk or damage for people, their activities or goods of any nature. (Peter, Jimena Martinez Llorente and Jens, 2015)

Main causes of noise

The main cause of noise pollution is human activity and is called "invisible pollution", they are vehicles, bars and public places, industries and workshops, etc. The effects produced by noise also mean a direct problem with people, causing serious consequences and health problems, derived from stress, the rhythm change in pulsations and breathing, among others. (Arango, Mayrena, 2017).

How sound pollution occurs

The growth of cities over recent years, and therefore, the increase in activities that take place in urban centers have caused a type of pollution that affects both labor relations and leisure and rest, this is Acoustic Pollution or Noise. The acoustic pressure is measured in decibels (dB) and the especially annoying ones are those corresponding to high tones (dB-A). The sound pressure becomes harmful at about 75 dB-A and painful around 120 dB-A. It can cause death when it reaches 180 dB-A. The tolerance limit recommended by the World Health Organization is 65 dB-A. The human ear needs more than 16 hours of rest to compensate 2 hours of exposure at 100 dB (noisy nightclub). Sounds over 120 dB (noisy rock band or loud volume in headphones) can damage cells sensitive to the sound in the inner ear causing hearing loss. Spain is the second noisiest country in the world after Japan, which occupies the first place. The causes of being the country with the highest levels of noise pollution are mainly due to poor planning and management to avoid this type of pollution and the

scarce awareness of danger that people can have exposed to a noise level higher than normal conditions (SICA, Information System on Acoustics, 2013).

Effects of noise pollution on health

The World Health Organization (WHO), the European Economic Community (EEC) and the Higher Council for Scientific Research (CSIC), have unanimously stated that noise has both physiological and psychological health effects. Prolonged exposure to noise can cause medical problems such as hypertension and heart disease.

Noises above 80dB can lead to aggressive behavior and psychiatric symptoms, although the main consequence is hearing loss. The adverse effects of noise may include: Headache, difficulty in oral communication and hearing, disturbed sleep and rest, stress, fatigue, depression, nervousness, gastritis and sexual dysfunction (Mayte Perez, 2015).

Physical Effects

Physio pathological reactions are those that physically affect the body in its functions and between them. When noise produces more than 60 decibels, the most frequent are: breathing and pulse acceleration, increase in blood pressure, decrease in digestive peristalsis which causes gastritis or colitis, neuromuscular problems that cause pain and lack of coordination, decreased night vision, increased fatigue and hard sleeping, among others. A lot of studies conclude that a constant noise above 55 decibels produces changes in hormonal and immune system that lead to vascular and nervous changes, such as increased heart rate and blood pressure, worsening of peripheral circulation, increased glucose, cholesterol and lipid levels. In addition, it affects sleep producing insomnia, which

will lead to a general fatigue that will diminish defenses and make possible the appearance of infectious diseases. (A constant exposure above 45 decibels prevents a peaceful sleep).

Psychological Effects

Among these effects we would mention stress, insomnia, irritability, depressive symptoms, lack of concentration, lower performance at work, etc. Mainly schoolchildren are who suffer these consequences, in most cases lack of concentration, even in their own homes, makes them have a lower school performance (ECODES, 2010).

Sound pollution and health

As mentioned, (ECODES, 2010) numerous scientists and experts dealing with this problem, and many official bodies including WHO, the EEC, the German Federal Environment Agency and the Spanish CSIC (Higher Council for Scientific Research), They have unanimously stated that noise has very harmful effects on health. These damages range from purely physiological disorders such as the known progressive loss of hearing, to psychological ones producing an irritation and fatigue that cause dysfunctions in daily life, both in work performance and in social relationship. The list of possible consequences of noise pollution is extensive: interference in communication, sleep disturbance, stress, irritability, decreased performance and concentration, aggressiveness, fatigue, headache, stomach problems, blood pressure disturbance , heart rate disorder, immune system depression (lowering of defenses), endocrine segregation levels, vasoconstriction, mental problems, depressive states, etc.

Methodology.

Geographical Location of the Research

This work was carried out in Alejo Lascano Avenue Km.1 Puerto Cayo road in Jipijapa city, located in southwest side province of Manabí, between following coordinates:

- West Length $80^{\circ} 25'$ and $80^{\circ} 52'$
- South Latitude $1^{\circ}10'$ and $1^{\circ}47'$ (25)

Concerning this area, it is made up of the cantons Jipijapa, Paján, Puerto López and 24 de Mayo. They occupy 3,441.49 km² of surface, which corresponds to 15.65% of the province of Manabí. Its economy is basically based on agricultural production subject to the inclemency or kindness of nature, in artisanal fishing and the nascent impulse of tourism. The Cantonal Header of Jipijapa has 44,870 inhabitants. The Alejo Lascano avenue belongs to the urban parish of San Lorenzo in Jipijapa, where the universe of 18,026 inhabitants was used. The type of sampling that was applied is the non-probabilistic one for convenience where 100 people were chosen to carry out the surveys.

People who live in this sector can observe the movement coming from the commercial activities that is generated in this avenue, as well as the circulation and stops of taxis, urban and provincial buses, on the other hand you can notice the traffic of light vehicles and heavy loads, which usually cause noise.

The present investigation was developed by observation method prior to determine the location and application of measurement, tabulation and interpretation of results.

In addition, the descriptive method was used because it is aimed to determine the levels of noise pollution and health effects on inhabitants. This investigation was executed in a period of two months (August and September) in working days (Monday and Tuesday) and non-working days

(Saturday and Sunday). The monitoring was made in three key points: Point 1 (initial part), point 2 (middle part), point 3 (final part) of Alejo Lascano Avenue. The measurement was made in a period of ten minutes for each key point, completing in the three points where the measurements were taken in periods of half an hour in each section, in the morning from 8:00 am to 8:30 am, at noon from 12:00 pm to 12:00:30 pm and in the afternoon from 5:00 pm to 5:30 pm. Tables and graphics were made according to the results obtained.



Figure N° 1.- Map of Alejo Lascano avenue where the 3 monitored points are indicated

The sound pressure levels were taken using a Larson Davis Sound Track Integral LxT1 s / n: 0003067 type 2 integrated sound level meter. Adjusted in weighting with A scale and Slow response. Also, the sound level meter was placed at 1.10 m. of the ground and 1 to 1.5 m, far from the house fences or enclosures.

We determined the main physiological and psychological effects that influence on population health around the study zone. Surveys were conducted on people related to the problem of noise pollution within the area of study, in order to fulfill the stated objective.

Results.

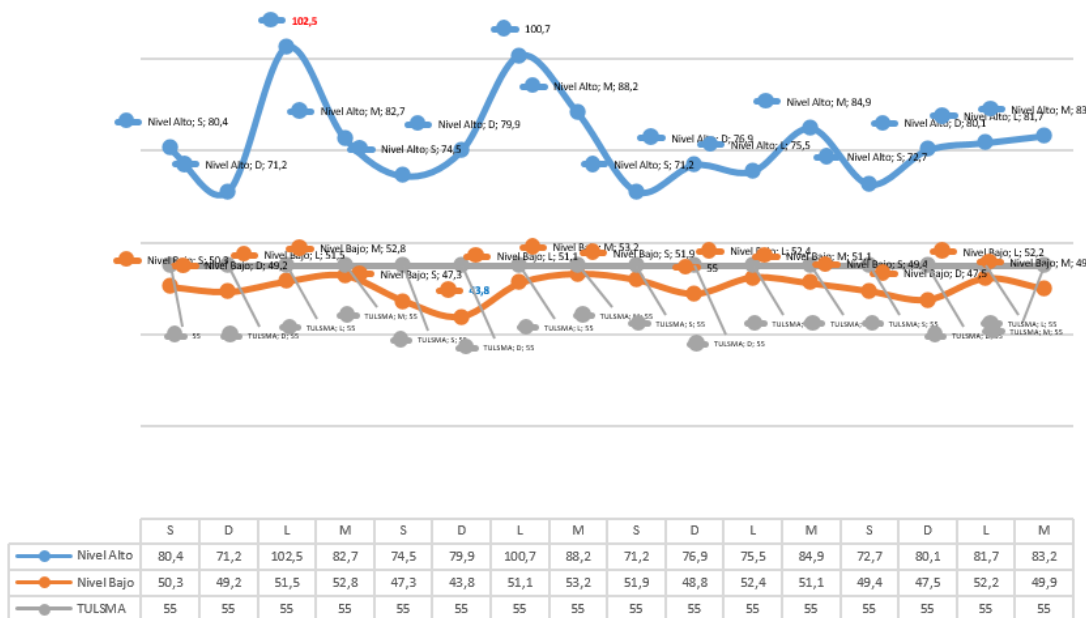
Table N ° 1: Daily averages in "decibels" at point 1 / August

Daily averages in working days and non-working days (rush hours)				
Place	Days	High level	Low level	TULSMA
Alejo Lascano avenue Km.1 Puerto Cayo road	Saturday 5	80,4	50,3	55
	Sunday 6	71,2	49,2	55
	Monday 7	102,5	51,5	55
	Tuesday 8	82,7	52,8	55
	Saturday 12	74,5	47,3	55
	Sunday 13	79,9	43,8	55
	Monday 14	100,7	51,1	55
	Tuesday 15	88,2	53,2	55
	Saturday 19	71,2	51,9	55
	Sunday 20	76,9	48,8	55
	Monday 21	75,5	52,4	55
	Tuesday 22	84,9	51,1	55
	Saturday 26	72,7	49,4	55
	Sunday 27	80,1	47,5	55
Monday 28	81,7	52,2	55	

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	Tuesday 29	83,2	49,9	55
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Source: Own elaboration



Graph N ° 1: August Point 1

Daily averages of measurements on working days and non-working days (peak hours) on Avenida Alejo Lascano Km.1 via Puerto Cayo in the city of Jipijapa

Analysis and interpretation of results obtained in August

Once the results were analyzed and interpreted according to table and graph N ° 1, the result was that on Monday, August 7, at point 1 of Alejo Lascano avenue, from 12H00-12H30 the maximum monthly average value is 102.5 dB (A), this value being higher than the allowable in Ecuador, recommended by the TULSMA of 55 dB (A) , it should be mentioned that the influence of noise was caused by the congested circulation of light and heavy vehicles, other sources of noise was the improper use of the horn caused by urban buses and motorcycles; However, on Sunday the 13th in

the afternoon from 5:00 PM to 5:30 PM the same month, the lowest level of noise pollution was observed in 43.8 dB (A).

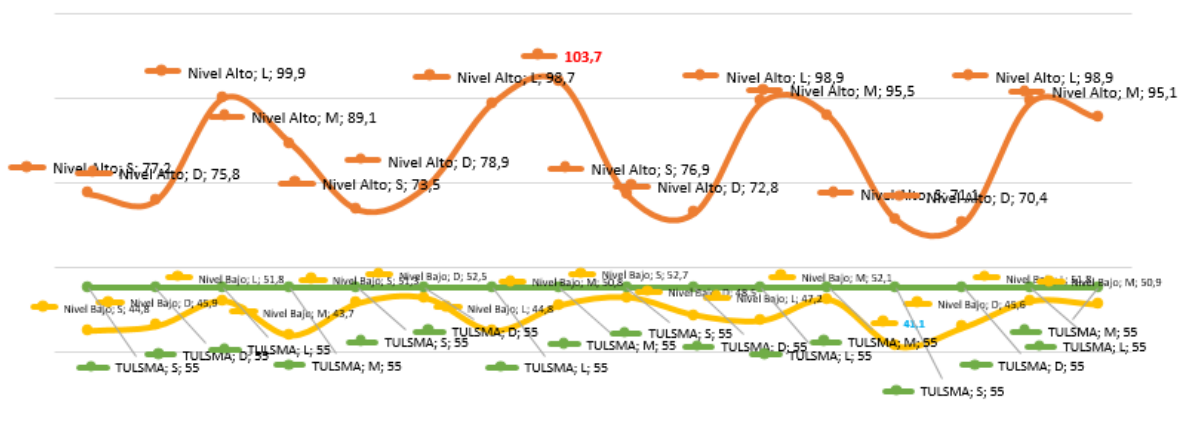
Table N ° 2: Daily averages in "decibels" at point 2 / September

Daily averages in working days and non-working days (rush hours)				
Place	Days	High level	Low level	TULSMA
Alejo Lascano avenue Km.1 Puerto Cayo road	Saturday 1	77,2	44,8	55
	Sunday 2	75,8	45,9	55
	Monday 3	99,9	51,8	55
	Tuesday 4	89,1	43,7	55
	Saturday 8	73,5	51,3	55
	Sunday 9	78,9	52,5	55
	Monday 10	98,7	44,8	55
	Tuesday 11	103,7	50,8	55
	Saturday 15	76,9	52,7	55
	Sunday 16	72,8	48,5	55

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	Monday 17	98,9	47,2	55
	Tuesday 18	95,5	52,1	55
	Saturday 22	71,1	41,1	55
	Sunday 23	70,4	45,6	55
	Monday 24	98,9	51,8	55
	Tuesday 25	95,1	50,9	55

Source: Own elaboration



	S	D	L	M	S	D	L	M	S	D	L	M	S	D	L	M
Nivel Alto	77,2	75,8	99,9	89,1	73,5	78,9	98,7	103,7	76,9	72,8	98,9	95,5	71,1	70,4	98,9	95,1
Nivel Bajo	44,8	45,9	51,8	43,7	51,3	52,5	44,8	50,8	52,7	48,5	47,2	52,1	41,1	45,6	51,8	50,9
TULSMA	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55

Graph N • 2: September Point 2

Daily averages of measurements on working days and non-working days (peak hours) on Avenida Alejo Lascano Km.1 via Puerto Cayo in the city of Jipijapa

Analysis and interpretation of results obtained in September

According to table and graph No. 2 it could be seen that the maximum monthly average value is 103.7 dB (A), obtained on Tuesday 11 at noon. This value is much higher than the allowable one in Ecuador, recommended by the TULSMA that is 55 dB (A) , it should be mentioned that the influence of noise was caused by the congested circulation of light and heavy vehicles, other sources of noise was the improper use of the horn caused by urban buses and motorcycles; However, on Saturday, the 22nd, in the afternoon from 5:00 pm to 5:30 pm, the lowest level of noise was observed, it was 41.1 dB (A).

Surveys applied

1.- Do you know what sound pollution is?

Table N • 3: Knowing what sound pollution is

Options	Frequency	Percentage
Yes	40	40%
No	60	60%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Once analyzed and interpreted table No. 3, 60% of surveyed people do not know about noise pollution, while the 40% remaining do have knowledge about the subject. According to these results we have that most of inhabitants have no clue of what noise pollution is.

2.- What do you think is the biggest source of noise on Alejo Lascano Avenue?

Table N • 4: Which would be the biggest source that causes more noise

Options	Frequency	Percentage
Motorcycles	40	40%
Traffic	50	50%
Commercial activities	10	10%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Analyzed and interpreted table No. 4, 50% of surveyed people believe that the biggest source of noise on Alejo Lascano avenue is traffic, while 40% believe that it is motorcycles and 10% remaining think noise is caused by commercial activities.

3.- Do you believe that noise pollution affects the health of people in Alejo Lascano avenue?

Table N ° 5: Sound pollution affects health of inhabitants

Options	Frequency	Percentage
Yes	65	65%
No	35	35%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Once analyzed and interpreted table No. 5, details that 65% of people ensure that noise pollution affects health of inhabitants, while 35% do not believe it.

4.- At what time do you think there is more noise on Alejo Lascano Avenue in Jipijapa city?

Table No. 6: At what time do you think you perceive the greatest noise

Option	Frequency	Percentage
08H00-08H30	17	17%
12H00-12H30	68	68%
17H00-17H30	15	15%

Total	100	100%
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Source: Own elaboration

Analysis and interpretation

Analyzed and interpreted the table No 6 that details that the 100 people surveyed 68% believe that in the hours they perceive that the highest noise is from 12H00 to 12H30, while 17% believe that it is in the hours of 08H00 to 08H30, the biggest noise and the remaining 15% is from 17H00 to 17H30 who perceive the greatest noise in Alejo Lascano Avenue

5.- What could the possible damages caused by the exposure to noise pollution in inhabitants of Alejo Lascano avenue?

Table N ° 7: What could be the possible damages caused by the exposure to noise pollution in inhabitants

Options	Frequency	Percentage
Stress	35	35%
Hearing loss	40	40%
Headache	25	25%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Once analyzed and interpreted the table No. 7 details that of the 100 people surveyed 40% of surveyed people said the main damage caused by noise pollution is hearing loss, while 35% agree that stress is the main consequence and the remaining 25% indicates headache is the possible damage caused by the exposure to noise pollution in the inhabitants of Alejo Lascano Avenue.

6.- Would you attend if environmental education workshops about noise pollution will be held?

Table N ° 8: Assist if environmental education workshops about noise pollution will be held

Options	Frequency	Percentage
Yes	82	82%
No	18	18%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Analyzed and interpreted table No. 8 details that of the 100 people surveyed 82% of people said they would attend environmental education workshops about noise pollution, while 18% answered that they would not attend environmental education workshops about sound pollution.

7.- Do you know that the Autonomous Decentralized Government (GAD) of Jipijapa city carries out controls on prevention and punishment about noise pollution?

Table N • 9: Knows if GAD performs controls on prevention and punishment about noise pollution

Options	Frecuency	Percentage
Yes	30	30%
No	70	70%
Total	100	100%

Source: Own elaboration

Analysis and interpretation

Once analyzed and interpreted table No 9 details that of 100 people surveyed 70% said that the Autonomous Decentralized Government (GAD) of the city does not perform controls on prevention and punishment about noise pollution, while the 30% answered that the city's GAD does controls on prevention and punishment about noise pollution.

Conclusions.

- An evaluation and monitoring process was made in rush hours on three different time lapses (08H00-08H30), (12H00-12H30), (17H00-17H30), working days (Monday and Tuesday) and non-working days (Saturday and Sunday) established in three different points of Alejo

Lascano Avenue Km.1 Puerto Cayo road in Jipijapa city in a period of two months (August and September); where the highest level of noise in August was presented at midday (12H00-12H30) on Monday 7 at point with a maximum average of 102, 5 decibels dB (A) the month of September the highest noise level was at the same time on Tuesday 11 at point 2 where a maximum average of 103.7 decibels dB (A) was given, these values being higher than permissible in Ecuador, recommended by the environmental regulations stipulated in book VI annex 5 of the TULSMA that is 55 decibels dB (A) in mixed residential areas.

- Possible damages caused by sound pollution with possible physiological and psychological effects was established through surveys. The environmental impact caused by noise is high, causing harmful effects to population such as possible hearing loss, headaches, nervous system alterations and stress, all of them really harmful for health of people.

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Bibliography.

- Andrea Rivera. (14 de Marzo de 2018). *Manabi Sonoro*. Obtenido de <http://www.eldiario.ec/noticias-manabi-ecuador/239063-el-ruido-y-sus-efectos-nocivos/>
- Arango, Mayrena. (18 de 04 de 2017). *Causas, Efectos y Soluciones*. Obtenido de <http://causasefectossoluciones.blogspot.com/2013/09/contaminacion-por-ruido.html>
- Constitucion de la Republica del Ecuador. (13 de Julio de (2011). *Constitucion de Ecuador 2008*. Obtenido de http://www.oas.org/juridico/pdfs/mesicic4_ecu_const.PDF

- Derek Agencias. (25 de Julio de 2012). *Efectos de la Contaminacion Sonora en Jipijapa*. Obtenido de <http://www.cooperativa.cl/noticias/sociedad/salud/la-contaminacion-acustica-provoca-serios-danos-a-la-salud-segun-la-oms/2008-09-25/130852.html>
- ECODES. (28 de Noviembre de (2010). *Efectos de la Contaminacion Acustica*. Obtenido de <http://ecodes.org/noticias/efectos-de-la-contaminacion-acustica-sobre-la-salud#.WiVyK0qWZpl>
- EcoLatino. (2018). *Contaminacion Sonora*. Obtenido de http://www.ecolatino.ch/index.php?option=com_content&view=article&id=119:contaminacion-sonora&catid=42:ecologia&Itemid=68
- EcuRed. (11 de Enero de 2018). *Sonometro*. Obtenido de <https://www.ecured.cu/Son%C3%B3metro>
- Federico Miyara. (2015). *La Acustica*. Obtenido de <https://www.fceia.unr.edu.ar/acustica/audio/acustica.pdf>
- G.A.D. Municipal del Canrton Jipijapa. (18 de Abril de (2015). *PDyOT Actual de Jipijapa*. Obtenido de http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/1360000630001_PDyOT%20ACTUAL%20JIPIJAPA%202015_18-04-2015_19-58-08.pdf
- Hypatia Sullyn Alvarado Guerrero. (2013). *Tesis Contaminacion Acustica*. Obtenido de <http://repositorio.uteq.edu.ec/bitstream/43000/105/1/T-UTEQ-0001.pdf>
- Julian Perez Porto. (2017). *Definicion de decibel*. Obtenido de <https://definicion.de/decibel/>
- Julio Villa. (27 de Abril de 2016). *El Riudo*. Obtenido de <http://www.elmundo.es/salud/2016/04/27/571f7504e2704ed1208b4585.html>
- Luis Landa. (21 de Agosto de 2013). *Ecuador Sonoro*. Obtenido de <http://www.elcomercio.com/cartas/contaminacion-auditiva.html>
- Maria Merino. (2013). *Definicion de Ruido*. Obtenido de <https://definicion.de/ruido/>
- Mayte Perez. (22 de Julio de 2015). *Efectos de la Contaminacion Acustica*. Obtenido de ontaminacionacustica.net/efectos-de-la-contaminacion-acustica-sobre-la-salud/
- Ministerio del Ambiente. (Marzo de (2017). *Leyes TULSMAN*. Obtenido de <http://www.ambiente.gob.ec/wp-content/uploads/downloads/2014/05/AM-161-Reforma-al-Titulo-V-y-VI-del-TULSMA-RO-631-01-02-2012.pdf>
- Ministerio del Ambiente. ((2017). *Libro VI Anexo V*. Obtenido de <http://extwprlegs1.fao.org/docs/pdf/ecu112184.pdf>

Peter, Jimena Martinez Llorente y Jens. (19 de 01 de 2015). *cuaderno_ruido_2013.pdf*. Obtenido de https://www.ecologistasenaccion.org/IMG/pdf/cuaderno_ruido_2013.pdf

Ricardo Mendez. ((2015). *Fuentes de Ruido*. Obtenido de https://www.lpi.tel.uva.es/~nacho/docencia/ing_ond_1/trabajos_02_03/Acustica_arquitectura/practica/FUENTES2.HTML

SICA, Sistema de Informacion sobre Acustica. (Junio de 25 de 2013). *Contaminacion Acustica*. Obtenido de <http://www.lineaverdeceutatrace.com/lv/consejos-ambientales/contaminacion-acustica/contaminacion-acustica.pdf>

Silvia Carmita Saquisili Guartamber. (2015). *Tesis Contaminacion Sonora*. Obtenido de <http://dspace.ucuenca.edu.ec/bitstream/123456789/21945/1/TESIS.pdf>

Teresa Pedregal. (2017). *Ruido en la Ciudad*. Obtenido de http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0186-72102017000100065