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The noise pollution of maritime traffic: The case of the Dardanelles' ferries

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Abstract

Noise pollution is one of Turkey's important environmental problems of today as it has impacted negatively on public health. This paper analyses the extent of noise levels emitted by public ferries at the Çanakkale port, Dardanelles. Measurements were taken 4 times a day in for a whole week with 5 hour intervals from 8.00 in the morning to 23.00 in the evening. It was found that the maximum noise level was 89.4 dB in a one-day measurement, while the minimum noise levels 60.0 dB. Similar results were obtained for the whole week of measurement where the maximum noise level was 91,1 dB and the minimum 60,1 dB . This gave an average weekly value of around 75 dB which was clearly higher than the EPA mean value of 70dB, and denoting the potential ill effect of noise pollution by ferry traffics in Dardanelles. This means that mitigating measures should be enhanced, some of which include diversion of the ferries away from the main port, use of noise reduction gears by vessels, the creation of vegetative buffer zone within the port vicinity, prohibition of horning by vessels, and stringent enforcement of the noise control laws.

Keywords: buffer zones, ferry, maritime vessels, mitigation measures, noise pollution, public health

Introduction

Sound is a part of daily life. The undesirable irritating sound that is not clear in daily life is called noise (Celen & Arin, 2003). These sources of noise should be prevented from spreading over the environment. Noise, defined as the undesirable and irritating sound, is gradually affecting a larger masses of people (Karabiber, 1991; Kumbur & Yalçın, 2000; Acar, 2001). The negative effects of noise are considered to be, environmental pollution. The least important noise may cause fight and nervousness among people. Noise levels especially in some of the developed countries may cause concern to the environment. For example, the noise level in the USA increases 1 dBA per year.

The surveys carried out in some countries have revealed that the most important and common source of noise affecting the greatest number of people is the noise of traffic (Community noise, 1995; Akerlöf, 1996). A considerable part of noise from small vehicles takes place in the interface between the road and the tire, while that of big vehicles from the exhaust (Baaj et al., 2001). Topping the list is the horn noise from maritime vessels such as ferries.

This paper looks at the hazards caused by noise pollution from maritime vessels with a special reference to the case of Çanakkale port, Dardanelles, Turkey.

Materials and method

The effect of noise level

Noise can be defined as undesirable, nasty sound. Sound is a physical phenomenon that is formed with the fluctuations a vibrating source makes and that alert the hearing sense in a person (Sharland, 1972). Therefore, it is important to analyze and control the environmental noise which may lead to loss of hearing, physiological and psychological effects (Sensöğüt & Çınar, 2006).

Noise causes the communication to get worse and reduces the physical and mental performance. The people working mostly in workshops or work places having machines are subjected to loud noise. Noise can cause serious functional problems in such places. Noise level at around 85 dBA can endanger audition if the noise lasts long. It may even give rise to deafness.

The negative effects of noise in human health are three folds; (1) Physiological effects: Loss of hearing, damage on the auditory sense and organ, disorders depending upon excessive increase of adrenalin. (2) Psychological effects: behavioral disorders, disorders in the nerves system, restlessness, slowdown in mental activities, deficiency in concentration, sleep disorder; and (3) Its effect on social life: the decrease of efficiency of work and productivity.

Besides these effects, noise is known to cause the character change such as depressions, and the lengthening of recovery periods of patients with various cardiovascular diseases (Liu and Tan 2000). The noise effects are generally hidden at 30- 65 dBA. The noise level at 65-85 dBA causes physical effects. Its negative effects on autonomous nervous system can be summarized as the contraction of muscle, skin and blood, decline in the pulse, and decrease of blood pressure (Sabancı & Uz 1984). Sound levels of over 85 dBA cause temporary and permanent auditory obstacle and the International Labour Organization (ILO) has accepted this level as the warning level (Table 1).

Table 1. Damage period at which noise level starts (International Labour Organization)

Sound level dB	90	92,5	95	97,5	100	102,5	105	110	115
Period (hour)	8	6	4	3	2	1,5	1	1/2	1/4

Source: http://actrav.itcilo.org/actrav-english/telearn/osh/noise/nomain.htm

Marine vessels are a serious source of noise pollution at least within the vicinity of their port location. The IMO Resolution A.468(XII) (1981) Code specifies noise levels on board of marine vessels as follows:

Noise Criteria*	
Space	*Noise Limit dB(A) Maximum*
Accommodation Spaces	
Cabins and hospitals	60
Mess rooms	65
Recreation room	65
Open recreation areas	75
Offices	65
Service Spaces	
Galleys, without food processing equipment operating	75
Serveries and pantries	75

∗ In any manned space with noise levels above 85 dB (A), hearing protection should be worn in accordance with appropriate IMO regulations.

Source: ILO Maritime Labour Convention, 2009

Noise pollution, like other pollutions, has reached up to the levels of harming people and environment (Avşar and Gönüllü, 1999). The situations such as the frequency of noise, the period of its presence in the environment, whether the noise has been caused by discrete, plane or linear source, the age, physical and psychological situation of the person subjected to noise, the distribution of noise according to time where it exists are the factors which are important for the noise to be perceived as discomfort (Gönüllü, 1993; Hasgür, 1998; Kurtuluş et al., 1997; Kurtuluş & Endeş, 1998).

The loss of hearing (Ward,1991; Lee, 1995; Leone & Feghali, 1984, Gönüllü, 1993), sleeplessness, nervousness, lack of attention and stress that noise causes considerably affect human life but these adverse impacts can be prevented through protective and precautionary measures (Fişek, 1983; Demireli, 1989). The birth weights of children born by mothers living near airports and exposed to noise were found to be lower than those of children born in a quiet environment (Belgin, 1994). Cohen and Weinstein (1981) found that the success rates of children

were higher in schools free of noise pollution than those in noisy schools, a finding confirmed by the study of Şahin (2006).

The study area

The problem of environmental noise is one of Turkey's current important environmental problems (The Report of Environmental Situation in Çanakkale 2006-2007: 330). Dardanelles is a 61 km (28 mile) long and from 1.2 to 6.4 km (3/4 to 4 miles) vital transportation bridge between the Black Sea and Mediterranean Sea. It separates Asian Turkey from European Turkey (Trace), thus it also separates the two continents.

Figure1. *Study location*

Data collection

The noise levels of ferries at the time of departure have been measured in this study using digital devices SL-824 to measure the sound levels. Public ferries going between Çanakkale and Eceabat were taken as the source of noise. The average length of these public ferries was 67 meters, the average number of vehicles that they carried was 62, the average number of passengers was 300 people and the average speed of these public ferries was 10 knot/hour.

The measurements were made in Çanakkale port. The measurements were made in open air at the same point but in different starting states of the ferry. These states were the maximum noise level of the ferry while taking the vehicles and passengers on board and getting to move on, and the minimum noise level when the ferry was running without taking the vehicles and passengers on board.

The measurements of noise were made in November, 2010. The measurements were made with SL- 824 digital noise measuring device at a 5 meter distance to the place where ferries docked. At a height of 1.25 meter, maximum and minimum values were determined and the means of them were obtained. The noise levels of measurement places were accounted as dB. The timing of the measurements for the maximum noise level was while the ferry was taking vehicles and passengers on board just before the departure time while the timing of the measurement of the minimum noise level was while the ferry was running before it took the vehicles and passengers on board.

Results and discussion

The difference in density between the water of the Black Sea and the Mediterranean resulting from the inflow of great quantities of fresh water into the Black Sea had the effect of producing a strong surface current flowing at a rate of up to 8.3km/5.2mi an hour from the Sea of Marmara into the Aegean - which made it difficult for small vessels to enter Dardanelles. This applied particularly when the so-called Dardanelles wind was blowing from the east-northeast to

Çanakkale city, while at the same time heavier ferry and ships with high noise content was flowing back along the Çanakkale (Figure 2).

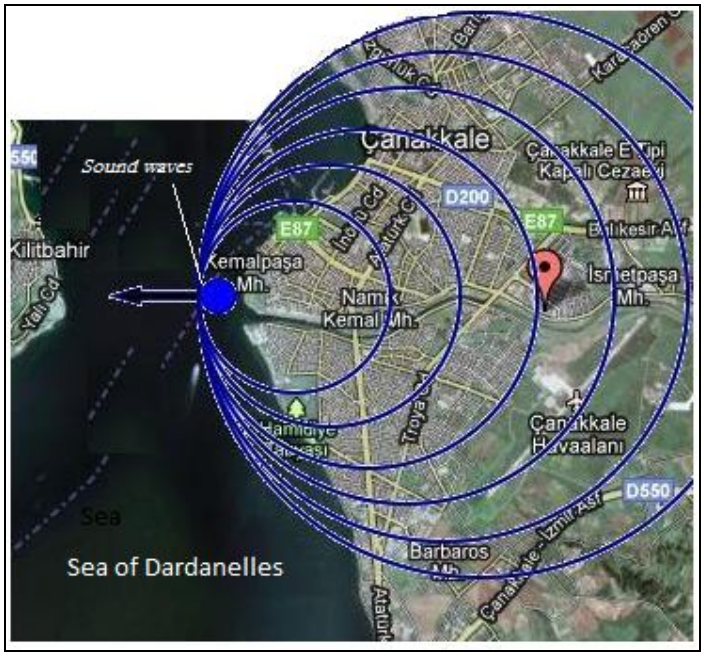

Figure 2. *Distribution of sound level in Canakkale City*

A one-day measurement was first carried out for this study. In this one-day measurement, 9 measurements were carried out with 9- hour intervals from 8.00 in the morning to 24.00 at midnight. Maximum and minimum values were determined and their averages were taken . The results are presented in Fig. 3. In this one-day measurement, the maximum noise level was 89.4 dB, while the minimum noise level was 60,0 dB.

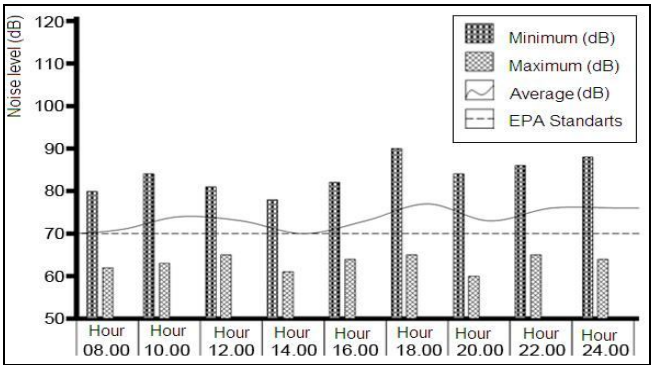

Figure 3. *Day's average measurement values per a week (dB)*

Subsequently, a one-week measurement was carried out. Four measurements a day were taken at 5 hour intervals from 8.00 in the morning to 23.00 in the evening. Maximum and minimum values were determined and the averages of them were taken. The data of one-week measurement were given in Figs. 4, 5, 6, 7, 8, 9 and 10.

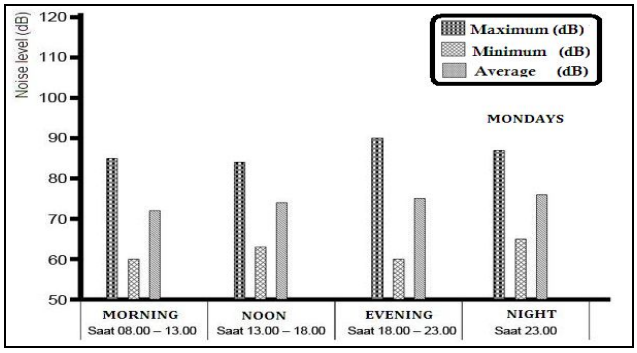

Figure 4. *Values of the measurements on the first day in a week (dB)*

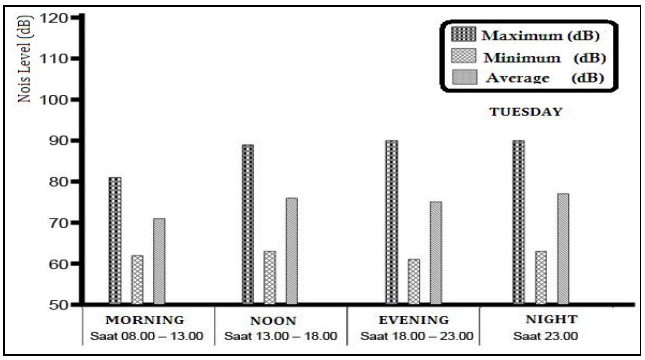

Figure 5. *Values of the measurements on the second day in a week (dB)*

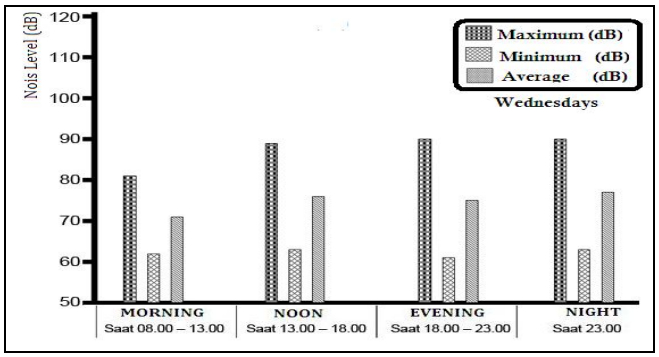

Figure 6. *Values of the measurements on the third day in a week (dB)*

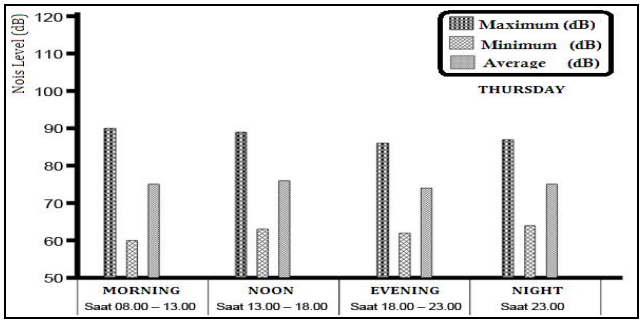

Figure 7. *Values of the measurements on the fourth day in a week (dB)*

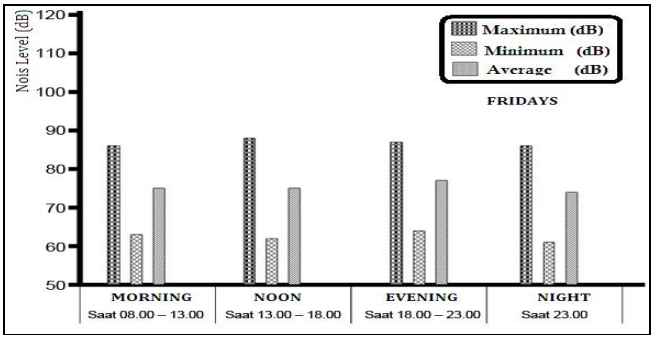

Figure 8. *Values of the measurements on the fifth day in a week (dB)*

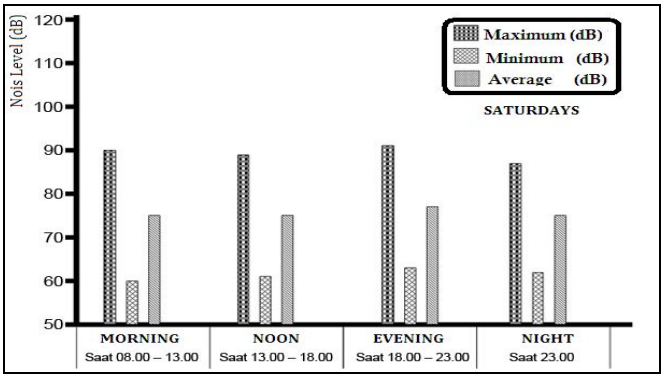

Figure 9. *Values of the measurements on the sixth day in a week (dB)*

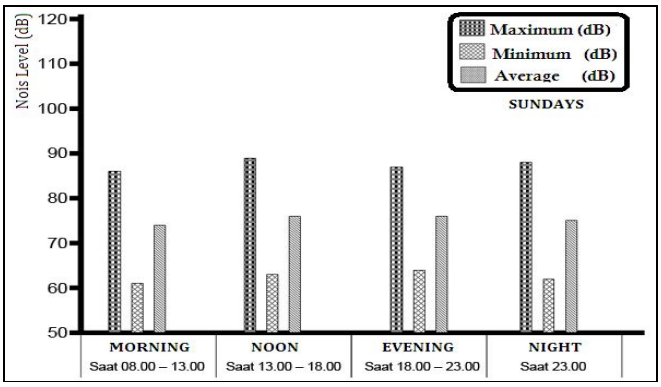

Figure 10. *Values of the measurements on the seventh day in a week (dB)*

The extreme noise level was 89.4 - 60.0 dB in the one-day. Similar results were obtained in the one-week measurement where the maximum noise level which was generally obtained in the mornings was 91,1 dB, while the minimum noise level was 60,1 dB. The mean of value of these one-week measurements was generally measured around 75 dB i.e. higher than the critical value that EPA determined (70 dB).

Conclusion and recommendations

Considering that the averages of the maximum and minimum values measured it is clear that the noise levels emitted by maritime vessels at Dardanelles' Canakkale port exceeded the safe limit of

70 dB, stipulated by the Environmental Preservation Agency (EPA). This indicates that the noise of ferries had the potentials of adversely affecting human health in Dardanelles.

While there cannot admittedly be absolute quiet in a maritime port some action plans may be considered to mitigate maritime noise pollution as follows: (1) Rearrangement of transportation in the city to minimize the impact of noise pollution of ferries; (2) Indiscriminate horning by ferries and other maritime vessels may be prohibited; (3) The manufacture and use of quiet sea vessels through innovative technologies instead of the old ones that now travel between Çanakkale and Eceabat; (4) Existing vessels must have equipments that prevent noise; (5) The dock may be moved outside the city to alleviate noise pollution that happens during the entrances and exits of the dock; (6) Public awareness campaigns may be waged and precautions taken may be continually monitored; (7) The construction of a bridge over Dardanelles will allow big vehicles to go to Eceabat without going into the city thus reducing noise pollution there; (8) In order to make maritime transportation businesses that serve between Çanakkale and Eceabat toe the line the noise prevention regulations must be obeyed to the latter; (9) The buffer zone of Çanakkale dock with the sprominade (kordon) may be forested to reduce in the vicinity by between 0.7-10,7 dB, taking into consideration the economic imperatives of the district (Uslu *et al*, 2000) and the suitability of the vegetation selected (Lertsawat et al., 1999).

References

Acar M (2001) Ülkemizde gürültü mevzuatının uygulanması ve karşılaşılan sorunlar. Gürültü Kontrol Yönetmeliğinin Revizyon Çalışmaları, Ulusal Sanayi-Çevre Sempozyumu Bildirileri, Mersin. p.759- 769.

Akerlöf L (1996) Acoustic guide, selection of acoustic quality in buildings. Sweden.

Avşar Y, Gönüllü MT (1999) Mecidiyeköy bölgesi gürültü düzeyi ve gürültü haritasının Çıkarılması. Kent Yönetimi ve Çevre Sorunları Sempozyumu, İstanbul.

Baaj MH, El-Fadel M, Shazbak SM, Saliby E (2001) Modeling noise at elevated highways in urban areas: A practical applicatıon**.** *Journal of Urban Planning and Development* **169**.

Belgin E (1994) Gürültünün insan sağlığına etkileri. TC Ankara Valiliği Çevre Koruma Vakfı, Kontrol ve Gürültü Sempozyumu, p.39–47.

Celen IH, Arın S (2003) Noise levels of agricultural tractors. *Pakistan Journal of Biological Sciences* **6** (19), 1706.

Çanakkale İl Çevre ve Orman Müdürlüğü (2007) Çanakkale İli Çevre Durum Raporu 2006 – 2007". Çanakkale. p.330.

Demireli O (1989) Konya Tümosan işçilerinde endüstriel işitme kayıpları araştırması. Doçentlik Tezi, Konya. p.2.

Fişek NH (1983) Halk Sağlığına Giriş. Hacettepe Üniversitesi Hizmet Araştırma ve Araştırıcı Yetiştirme Merkezi Yayını, No. 2. Hacettepe Üniversitesi Basımevi, Ankara. p.3-6.

Gönüllü MT (1993) Gürültü Kontrolü Ders Notları. Yıldız Teknik Üniversitesi, İstanbul.

Hasgür İ (1998) Gürültü Kirliliğinin Türk Mevzuatındaki Yeri" Çevre Dergisi, p.31-33.

Karabiber Z (1991) Gürültü-İnsan Etkileşimi". Türkiye'de Çevre Kirlenmesi Öncelikleri Sempozyumu Bildirileri, I. Cilt, İstanbul. p.457 – 469

Kumbur H, Yalçın E (2000) Mersin'de Gürültü Düzeylerinin Yıllara Göre Değişimi ve Gürültü Kirliliği Haritasının Oluşturulması. GAP Çevre Kongresi Bildirileri, Şanlıurfa. p.949 – 962.

Kurtuluş C., Endeş H, Gökergil B, Baysungur R (1997) İzmit Kent Bütünü İçinden Geçen Ulaşım Koridorları Boyunca Ses Kirlenmesinin Saptanması ve Gürültü Haritalarının Çıkarılması", 3. Ulusal Akustik Kongresi, p.11-21.

Kurtuluş C, Endeş H (1998) İzmit'te Karayolu ve Demiryolunda Taşıt Gürültüsünü Etkiyen Etmenlerin İncelenmesi. Uygulamalı Yerbilimleri Dergisi. KO.Ü Yayın Organı,S.1,C.1. p.31-38.

ILO (2011) Available from: http://actrav.itcilo.org/actrav-english/telearn/osh/noise/nomain.htm.

ILO Maritime Labour Convention (2009) American Bureau of Shipping Incorporated by Act of Legislature ff The State Of New York 186.

Lee KJ (1995) Essential otolaryngology, 6th ed. Appleton & Lange, Norwalk.

Lertsawat K, Tangjaitrong S, Areebhol P (1999) Prediction of noise emission from power plant by a mathematical model. *Applied Acoustics* **58**, 469-477.

Leone LA, Feghali JG, Linthicum FH (1984) Endolymphhatic sac: Possible role in autoimmune sensorineural hearing loss. *Ann Otol Rhinol Laryngol* **93**, 208–209.

Liu EHC, Tan SM (2000) Patients' perception of sound levels in the surgical suite. *Journal of Clinical Anesthesia* **12**, 298-302.

Sharland I (1972) Woods practical guide to noise control. Woods of Colchester Ltd., May, England. p.208.

Şahin GY (2006) Havaalanı Gürültüsünden Kaynaklanan Çevre Problemleri. K.T.Ü., Fen Bilimler Enstitüsü, Seminer, Trabzon.

Şensöğüt C, Çınar İ (2006) Çevresel Faktörlerin Gürültü Yayılımına Etkisi. *Dumlupınar Üniversitesi Fen Bilimleri Enstitüsü Dergisi Sayı* **10**, 131-132.

Uslu G, Koçer N, ve Öbek E (2000) Elazığ'da Gürültü Kirliliğinin Araştırılması. F.Ü. Fen ve Müh. *Bilimleri Dergisi* **12** (1), 121-128.

Ward WD (1991) Noise-induced hearing damage. In: Paparel a MM, Shumrick DA, Gluckman JL, Meyerhoff WL (eds) *Otolarynology 3 rd ed*, 1639-1652,3. WB Saunders, Philadelphia.