RESEARCH PAPER | Environmental Sciences | Volume : 4 | Issue : 10 | October 2014 | ISSN - 2249-555X

Seasonal Variations in Traffic Flow Rate Versus Leq At Major Crossings Of NH1A Jammu City, India

KEYWORDS: L_{eq}, Traffic Flow rate, Correlation

Akanksha kaushal
Department of Environmental Sciences, University of Jammu, Jammu- 180006 (J&K), India.

Rajkumar Rampal
Department of Environmental Sciences, University of Jammu, Jammu- 180006 (J&K), India.

ABSTRACT *The present study has been carried out to assess the traffic noise level (Leq) at five major crossings of NH1 A highway of Jammu city at three time periods of the day viz. Morning (8-10hrs.), noon (12-2 hrs.) and evening (6-8 hrs.) for three seasons i.e. rainy, summer and winter season. Besides this traffic flow rate for the sites was also assessed during the study. The study revealed that noise levels were higher during the rainy season as compared to winter and summer season for the given sites. All the sites exhibited positive correlation between traffic flow rate and Leq values during all the seasons.*

INTRODUCTION

With the rapid pace of development along with global environmental problems such as air pollution, water pollution, loss of bio-diversity, climate change etc., noise pollution is also becoming a concern for human society in urban areas. In developing countries, the problem of noise pollution has been not properly recognized. Vehicular traffic acts as a significant contributor source of noise. Motor vehicles, which are an inherent part of the urban dwellers, play a vital role in urban noise pollution, i.e. they contribute about 55% to the total noise. The rapidly increasing population followed by large number of vehicles gives rise to unrestrained noise pollution with its associated health effects and can cause both short-term as well as long-term psychological and physiological disorders. Noise pollution has an adverse impact on human health. It also causes annoyance, nausea, insomnia, thus affecting the working efficiency. Therefore it is important to evaluate noise level of particular place to know whether the noise level is above or below permissible limits. Numerous noise surveys to assess the noise pollution in many cities throughout the world have been conducted [Katrin Rehdanz *et al* 2008; U.W. Tang *et al* 2007; Catherine Driussi *et al*, 2006; Ö. Gündoğdu *et al*, 2005; Padma S. Rao *et al*, 2004; O. Guasch *et al*, 2002]. The present study has been carried out to assess seasonal variations in Equivalent noise level (L_{eq}) and Traffic flow rate at five major crossings of NHIA highway of Jammu city during three time periods of the day viz. Morning (8-10hrs.), noon (12-2 hrs.) and evening (6-8 hrs.) for three seasons i.e. rainy, summer and winter season. Further correlation between the traffic flow rate and corresponding L_{eq} was determined for all the sites during the three seasons.

MATERIALS AND METHODS

Study area: The study area has been divided into five sites: **Site-I** (Satwari crossing): This crossing is the gateway of vehicles into the Jammu city. Public and Private vehicles plying to Pathankot via Samba, Kathua and to the airport follow this crossing. **Site-II** (Vikram crossing): This crossing connects old Jammu city with the new Jammu city. Traffic flow includes vehicles coming from university road and vehicles on the main highway. Muthi-Bagh-e-Bahu temple, Janipur- Satwari, Ambphalla-Channi, Parade-Railway station, Ambphalla-Airport, Parade-Gandhi Nagar traffic routes of local transport pass through this crossing. **Site-III** (Jewel crossing): It is one of the busiest crossings of the Jammu city. The traffic routes to Talab Tillo, Gumat, Bus Stand, Satwari pass through this crossing. **Site-IV** (Rehari crossing): This crossing on NHIA lies next to Jewel crossing. Vehicles going to Rajpura, Parade, Bantalab, Janipur and out of the city pass through this crossing. **Site-V** (Ambphalla crossing): This crossing forms the exit point of Jammu city.

The measurement of sound pressure level was done with the help of calibrated Digital Sound Level Meter (Data Logger Model: 407764A). The noise levels were recorded thrice i.e. Morning period (0800-1000hrs.), Noon Period (1200-1400hrs.) and Evening period (1800-2000hrs.) a day at different selected sites. At each site the sampling of noise was done thrice randomly on three days during specific season. The procedure was repeated for the three seasons. From the observed reading of SPL (Sound Pressure level) Leq was calculated as:

$$1.\quad L_{eq} = 10\log\left(\sum_{i=1}^{n} f_i 10^{Li/10}\right)\text{dB (A)}$$

Where Li = sound intensity

fi = fraction of time for which sound pressure level persists

i = time interval

n = number of observations

The Traffic Flow rate was calculated by visually counting the total number of vehicles plying to and fro in period of ten minutes during three time periods of the day i.e. 0800-1000hours, 1200-1400 hours and 1800-2000 hours.

OBSERVATION AND DISCUSSION (Table I- III)

The analysis of the noise level data (L_{eq}) revealed that Rainy season exhibited higher values of L_{eq} followed by that of summer and winter season at all sites. During rainy season the maximum L_{eq} value was 92.93dB for Site II during evening hours (18-20 hours). The minimum L_{eq} observed was 81.96dB for Site V during 8-10 hours. During summer season maximum L_{eq} (88.19dB) was again observed for Site III during 18-20 hours and minimum value (78.43dB) for Site IV during 8-10 hours. During winter season higher L_{eq} values (88.68dB) were observed for Site V

Volume : 4 | Issue : 10 | October 2014 | ISSN - 2249-555X

during 18-20 hours and Site IV exhibited least values of L_{eq} (74.11dB) during 12-14 hours.

The critical analysis of the data revealed that different sites exhibited different L_{eq} values during different time periods of the day. During rainy season all the sites showed maximum values of L_{eq} during 18-20 hours. Similarly during summer season all the sites except Site IV exhibited highest L_{eq} values during 18-20 hours. While during winter season Sites II, III and IV showed highest L_{eq} values during 8-10 hours whereas Site I and V exhibited maximum L_{eq} during 18-20 hours.

The statiscal analysis of data revealed that all the sites exihibited positive correlation between traffic flow rate and L_{eq} values during all the study seasons. During rainy season: **Site-I-** Satwari crossing (r=0.98) **Site-II**-Vikram crossing (r=0.81) **Site-III** -Jewel crossing (r=0.99) **Site-IV**-Rehari crossing (r= 0.91) and **Site-V**-Ambphalla crossing (r=0.89) exihibited significant ($p<0.05$) positive correlation between traffic flow rate and L_{eq}. During summer season: **Site-I-** Satwari crossing (r =0.80) **Site II-** Vikram crossing (r =0.96) **Site-III-** Jewel crossing (r =0.98) **Site-IV-** Rehari crossing (r =0.99) and **Site-V-** Ambphalla crossing (r=0.98) also exhibited significant ($p<0.05$) positive correlation between traffic flow rate and L_{eq}. During winter season: **Site-I-** Satwari crossing (r =0.96) **Site-II-** Vikram crossing (r =0.85) **Site-III-** Jewel crossing (r =0.99) and **Site-IV-** Rehari crossing (r =0.89) exhibited significant positive correlation ($p<0.05$) while **Site-V-** Ambphalla crossing (r =0.99) exhibited insignificant positive correlation ($p>0.05$) between traffic flow rate and L_{eq}. But all the values of observed noise levels (L_{eq}) at different sites were above the permissible limits of 65.0 dB (A) and 55.0 dB (A) for commercial and residential areas respectively as prescribed by Environment protection rules (1986) and set by Central Pollution Control Board.

Ravichandran *et al.* (1998) in Hosur (Tamilnadu), Das *et al*. (1999) in Jaipur, Pandya and Srivastava (1999) in Jabalpur, Raina and Aggarwal (2003) in Jammu city, Rampal and Pathania (2008) in Bishnah town of Jammu, Rampal and Sharma (2008) in major road crossings of old Jammu city also observed the values of noise levels above the noise levels of commercial and residential areas as prescribed be Central Pollution Control Board. Chakraborty *et al. (1998)* reported the status of road traffic noise and community response in Calcutta metropolis in terms of seasonal basis. Subramani *et al*. (2012) observed positive correlation between humidity and noise values.

From the above discussion it was concluded that Rainy season exhibited highest noise levels (L_{eq}) as compared with that of summer and winter season. The present observation supports the observation made by Subramani *et al*. 2012 that noise levels increase with increase in humidity levels.

Table 1: Seasonal variations in L_{eq} (dB A) at different crossings of study area.

Sites/ Crossing	Rainy season			Summer season			Winter season		
	8-10 hr	12-14 hr	18-20 hr	8-10 hr	12-14 hr	18-20 hr	8-10 hr	12-14 hr	18-20 hr
Satwari(I)	91.24	89.80	91.75	80.44	81.26	84.19	76.34	77.18	78.32
Vikram(II)	89.31	90.28	92.93	81.68	83.02	86.18	77.43	74.19	75.02
Jewel(III)	91.14	89.35	92.82	85.34	87.43	88.19	83.43	81.02	82.44
Rehari (IV)	84.69	86.01	88.15	78.43	82.66	82.19	76.43	74.11	75.19
Ambphalla (V)	81.96	89.36	81.04	79.41	81.88	84.33	80.03	79.18	88.68

Table 2: Seasonal variations in Traffic flow rate at different crossings of study area.

Sites/ Crossing	Rainy season			Summer season			Winter season		
	8-10 hr	12-14 hr	18-20 hr	8-10 hr	12-14 hr	18-20 hr	8-10 hr	12-14 hr	18-20 hr
Satwari(I)	531	485	535	457	523	541	536	565	581
Vikram(II)	585	644	657	497	538	573	598	568	590
Jewel(III)	514	464	556	523	547	565	597	558	582
Rehari(IV)	489	524	536	383	458	440	540	486	534
Ambphalla (V)	485	549	565	395	433	452	584	580	603

Table 3: Correlation between traffic flow rate and L_{eq} during different seasons .

Sites/Crossing	Rainy season		Summer season		Winter season	
	r	p	r	p	r	p
Satwari(I)	0.98	0.001	0.80	0.003	0.96	0.0006
Vikram(II)	0.81	0.0015	0.96	0.002	0.85	0.0002
Jewel(III)	0.99	0.003	0.98	0.0006	0.99	0.0004
Rehari(IV)	0.91	0.0009	0.99	0.003	0.89	0.001
Ambphalla (V)	0.89	0.002	0.98	0.001	0.99	6.48

r(pearson coefficient) , p(significance)

Volume : 4 | Issue : 10 | October 2014 | ISSN - 2249-555X

REFERENCE

Catherine, D. and Jansz, J. 2006. "Technological options for waste minimisation in the mining industry". Journal of Cleaner Production 14, pp. 682-688 | Chakraborty, D., Santra S.C. and Roy B. Survey of community annoyance due to traffic noise-exposure in Calcutta metropolis. Journal of Acoustic Society India 1998; 26:39-43. | Rehdanz, K. and Maddison, D. 2008. "Local environmental quality and life-satisfaction in Germany" Ecological Economics 64, pp. 787-797 | Das, D.B., Bakra, P.P. , Arya, P., Bhargava, A. and Gupta, A.S. (1999). Environmental Noise: Psychological, Physiological and ambient assessment at Industrial, Residential and Commercial places of an urban area in Rajasthan. Indian Journal of Environment Protection, 19(7): 481-487. | Guasch, O., Magrans, F.X. and Rodriguez, P.V. 2002. "An inversion modelling method to obtain the acoustic power of the noise sources in a large factory" Applied Acoustics, 63, pp. 401-417 | Gündoğdu, O., Gökdağ, M. and Yüksel, F. 2005. "A traffic noise prediction method based on vehicle composition using genetic algorithms." Applied Acoustics, 66, pp. 799-809. | Padma S. Rao, Gavane, A.G., Ankam, S.S, Ansari, M.F., Pandit,V.I. and Nema, P. 2004. "Performance evaluation of a green belt in a petroleum refinery: a case study" Ecological Engineering 23, pp.77-84. | Pandya, M. and Srivastava, R.K. (1999). Analysis of noise levels and its health effects in commercial areas of Jabalpur city: Part I of analysis of noise levels, Indian Journal of Environmental Sciences, 3(2): 197-200. | Raina, A.K. and Aggarwal, B. (2003). Assessment of noise levels in some areas of Jammu city. Nature Environment Pollution Technology, 2(4): 479-484. | Rampal, R.K. and Pathania, D. (2008). Assessment of noise level in households of Bishnah town, Jammu (J&K), India. Pollution Research, 27(1): 69-72. | Rampal, R.K. and Sharma, A. (2008). Noise levels in major road crossings of old Jammu city. Indian Journal of Environment and Ecoplan, 15(1-2): 161-166. | Ravichandran, C., Chandrashekharan, G. And Venkatasubramaniam, R. (1998). Status of noise pollution in Hosur (Tamilnadu). Indian Journal of Environment Protection, 18(4): 278-280. | Subramani, T., Kavitha, M. and Sivaraj, K.P. (2012). Modelling of Traffic noise pollution. International Journal of Engineering Research and Applications, 2(3): 3175-3182. | Tang, U.W. and Wang, Z.S. 2007. "Influences of urban forms on traffic-induced noise and air pollution: Results from a modelling system." Environmental Modelling & Software, 22, pp. 1750-1764. |