iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** XII **Month of publication:** December 2014

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Evaluation and Analysis of Road Traffic Noise on a National Highway

Arun Kumar Mishra[1], Prabhat Srivastava [*2]
[1] Assistant Professor, Civil Engineering Department, M.M.M.U.T Gorakhpur-273010
[2] Ex. Professor and Head, S. P. College of Engineering Mumbai-400076

Abstract: ***Noise pollution has been well recognized as one of the major cause of concern that impacts the quality of life in urban areas across the globe. Traffic noise from highways creates problems in the surrounding areas specially when there are higher traffic volume and high speeds. In the present study, the traffic noise along a highway corridor on NH222 passing near Kalyan city, Maharashtra, have been observed and measured at various location by sound level meter(Bruel and Kjaer type 225). The traffic noise prediction at all the locations has been done by FHWA model. The percentage error between the observed and predicted values of noise level has been calculated. An agreement diagram has been plotted between the observed and predicted values of noise level and it indicates that noise level predicted by FHWA model lie within an error band of 10% with reference to the observed values of the noise level. Present study indicates that FHWA model can be used for the prediction of noise level for Indian conditions.***
Keywords: ***Noise level, FHWA Model, Human health, City of Kalyan, Modeling.***

I. INTRODUCTION

Noise is a common environmental pollutant in nearly all urban communities. Noise can be emitted from various sources such as aircraft, road traffic, railways, construction, factories, etc. Among these, road traffic is a major source of noise in the urban areas contributing to 55% of the total noise. Social surveys conducted in various cities throughout the world indicated that traffic noise is the major source of nuisance and annoyance [1,2].Social survey conducted in various cities throughout the world indicated that traffic noise is the main source of nuisance and annoyance [3,4].The effect of noise depends on various factors such as time duration, noise sound level, distance from the source, etc. The health impact associate with the noise pollution on human well-being is done by various researchers [5, 6, 7, 8]. The CBCB of India in its notification for noise has laid down the ambient noise standards [9]. FHWA model was found to be suitable for the prediction of noise in India within a fair degree of accuracy.

A. FHWA Model

In the present study Federal Highway Administration Model (FHWA model) has been used for prediction of noise level. Vehicles were classified into seven categories. The hourly Leq value foe each category of vrhicle is calculated using the following formulae

$$\mathbf{L_{eqi} = L_O + A_{vs} + A_D + A_S}$$

L_{eqi} = Hourly equivalent noise level for each vehicle type
L_O = The reference energy mean emission level
A_D = Distance correction
A_{vs}= Volume and speed correction
A_S = Ground cover correction

B. Calculation of equivalent noise level

Noise level for each vehicle type (L_{eqi}) is calculated and then calculates logarithmically to get the total hourly L_{eq}value and the combined hourly L_{eq}value is calculated by logarithmic summation of hourly L_{eq}value of each category.

ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

$$L_{eq} = 10log \sum_{i=1}^{i=n} 10^{L_i/10} \times t_i$$

Where n = total number of sound samples

L_i = noise level of any i^{th} sample

t_i= time duration of i^{th} sample expressed as fraction of total sample time

II. MATERIAL AND METHODS

A. Site Description

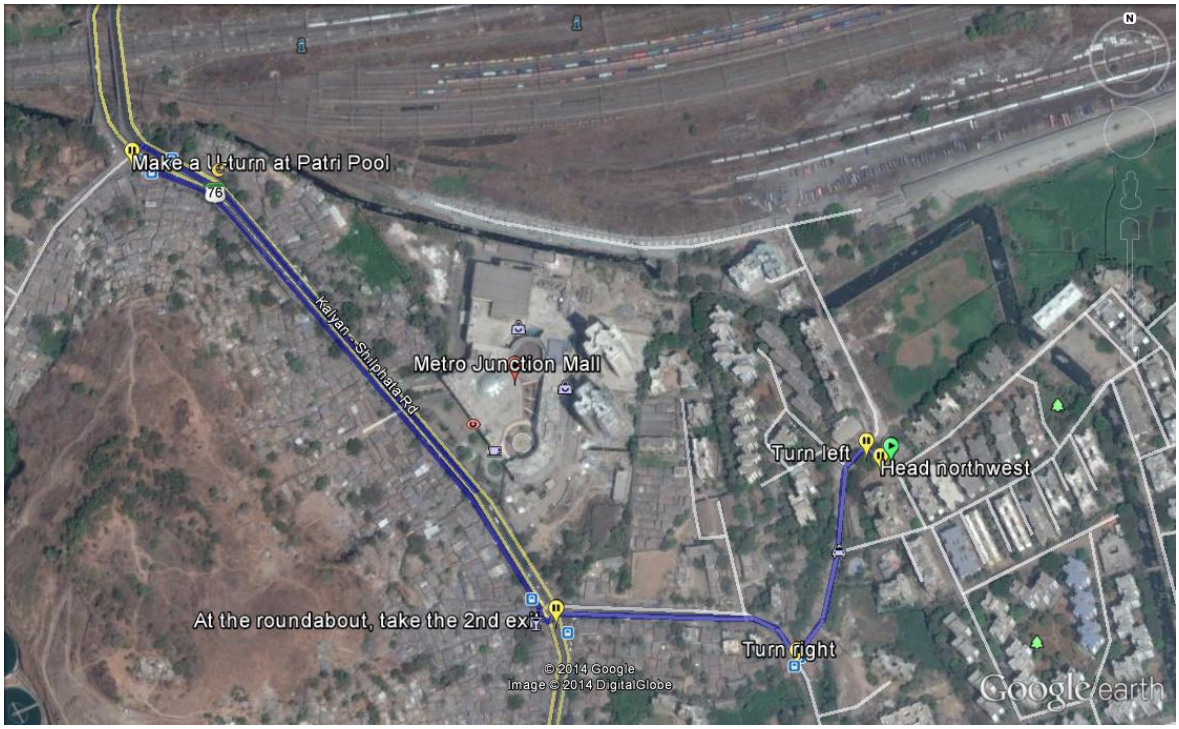
This study was mainly carried out to measure the noise level on fraction of NH 222 which is passing through the Kalyan city, Maharastra, India. Location of monitoring stations was selected considering different zones on the national highway.Noise monitoring were carried out at seven locations. Details about the monitoring stations are given in table 1**.** Location map of study area is shown in fig. 1. The ambient levels of noise for different areas/zones specified in the rules are indicated in table 2**.**

Table 1: Location of Monitoring Stations

S.N.	Name of Monitoring Station	Type of Area
1	Kalyan Bus Stand	Commercial area
2	Patri Pool	Residential area
3	Netivali Chauk	Commercial area
4	Suchak Naka	Commercial area
5	Tata Power Station	Industrial area
6	Sonarpara	Residential area
7	Kalyan Shilphata	Commercial area

Table 2: Ambient noise standards by CPCB

Area Code	Category of Area/Zone	Limits in dB*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40



(Source: Google map)

Fig 1: Location map of study area

B. Measurement Of Ambient Noise Level

Noise levels db(A) were collected at all the locations for 10 hour duration starting from 8:00 am to 12 noon and then 2:00 pm to 8:00 pm. Sampling were carried out at mid hour from 25 minutes to 35 minutes for 10 minutes duration. The noise level were recorded at 15 second intervals. Hence for 10 minute duration 40 data were recorded The noise level recording was done by noise level meter of make 'Bruel and Kajer' Denmark. During sampling process distance from the centerline of the road was taken as 10 meters.

C. Traffic Volume

Traffic volumes were calculated at all the selected sides. Total number of vehicles passes in each type, passing in hour in a single direction was recorded and expressed in veh/hour.

D. Spot Speed Measurement

Due to unavailability of Doppler Radar Speedometer, manual method was used for spot speed measurement of the vehicles in the present study. For this purpose two points were marked with a known distance (75m apart) on the road at the sampling site. With the help of a stopwatch, the time taken by the vehicles to cover the above distance (i.e. 75 m) was recorded and by dividing the distance with the time taken by the vehicles, the speed in km/hr for each type of vehicle was calculated.

III. RESULT AND DISCUSSION

Results obtained from FHWA model were compared with observed values of the noise levels. An agreement diagram was plotted between observed and predicted values of the noise levels as shown in figure 2. Observed and predicted values of the noise levels at different locations are given in the table 3 to table 9. From the agreement diagram it was found that percentage error of noise level between observed and predicted values are within 10%.

Table 3: Comparison of noise levels at NH 222- Kalyan Bus stand

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	85.03	76.46
09-10	82.91	76.73
10-11	79.26	70.41
11-12	77.76	66.93
14-15	76.34	66.97
15-16	72.61	67.03
16-17	70.98	67.11
17-18	87.22	77.32
18-19	96.74	86.48
19-20	97.14	93.21

Table 4: Comparison of noise levels at NH 222- Patripul

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	78.35	76.46
09-10	77.19	67.12
10-11	76.79	71.45
11-12	72.42	67.71
14-15	69.36	63.13
15-16	74.26	68.47
16-17	73.23	65.41
17-18	79.58	70.26
18-19	80.27	77.65
19-20	78.85	70.38

Table 5: Comparison of noise levels at NH 222- Netivali Chauk

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	71.65	67.59
09-10	75.16	68.92
10-11	71.17	67.47
11-12	74.38	71.92
14-15	74.92	67.35
15-16	74.17	68.63
16-17	74.23	67.41
17-18	76.34	65.91
18-19	79.73	70.40
19-20	80.51	75.31

Table 6: Comparison of noise levels at NH222- Suchak Naka

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	77.88	69.47
09-10	78.49	69.89
10-11	78.89	70.38
11-12	70.42	66.45
14-15	69.48	66.39
15-16	68.66	62.32
16-17	67.12	64.85
17-18	77.74	70.20
18-19	78.81	74.26
19-20	80.64	73.46

Table 7.0: Comparison of noise levels at NH 222- Tata Power

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	78.68	72.51
09-10	82.55	74.64
10-11	78.69	75.66
11-12	76.39	69.62
14-15	74.07	68.63
15-16	72.52	66.87
16-17	71.14	64.54
17-18	77.75	69.25
18-19	85.95	78.19
19-20	86.76	77.86

Table 8.0: Comparison of noise levels at NH 222- Sonarpara

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	77.23	67.87
09-10	76.08	69.76
10-11	78.12	69.54
11-12	77.54	89.35
14-15	74.55	67.31
15-16	73.45	68.65
16-17	71.32	66.51
17-18	81.98	75.25
18-19	85.47	78.21
19-20	86.66	77.52

Table 9.0 Comparison of noise levels at NH 222- Shil Phata

Time(hour)	Observed hourly Leq	Predicted hourly Leq
08-09	80.86	77.62
09-10	89.52	76.86
10-11	87.78	79.03
11-12	79.69	71.64
14-15	76.85	68.21
15-16	74.20	67.36
16-17	69.25	62.83
17-18	79.88	77.91
18-19	84.35	75.23
19-20	86.37	75.45

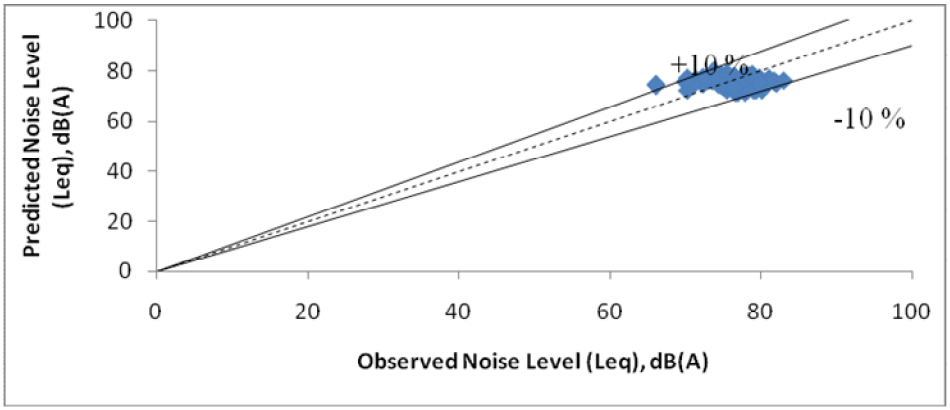


Fig. 2: Agreement Diagram for FHWA Model

IV. CONCLUSION

This study was conducted to evaluate the road traffic noise pollution along the national highway corridor in the city of Kalyan and to assess the impacts on residents. On the basis of result, the following conclusions were made:

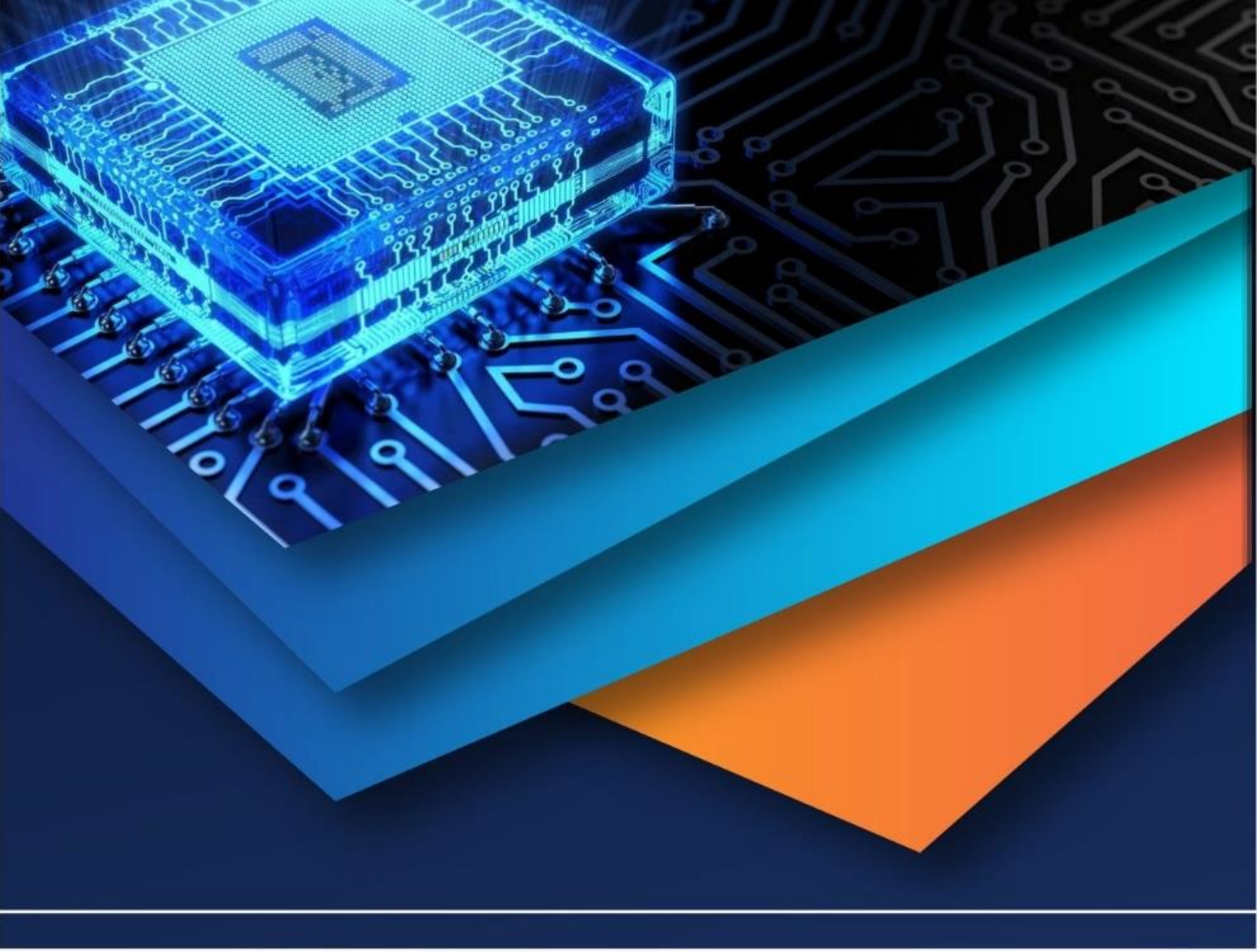
1. The measured and predicted road traffic noise levels at all the studied locations were higher than the prescribed limit given by the Central Pollution Control Board (CPCB).
2. Federal Highway Administration model (FHWA Model) can be applied successfully to predict traffic noise level under traffic conditions in the city of Kalyan.
3. Results obtained from the social survey, revealed that road traffic noise is a major concern to the people residing in the vicinity of the studied locations.
4. With a view to control the traffic noise, the restrictions on the traffic flow and speed can be planned specially along the highway corridors located in the vicinity of cities and urban areas.

V. ACKNOWLEDGEMENT

The authors are thankful to Dr. S. L. Dhingra and Dr. R S.Patil, Professors, Civil Engineering Department, I.I.T. Bombay , India for their valuable guidance and suggestions.

REFERENCES

[1] Pandya, G.H " A Comprehensive investigation of noise exposure in and around an integrated iron and steel works," American Industrial Hygiene Association, 2002,Vol. 63, pp 172-177.
[2] Sinha, S and Sridharan, P.V " Present and future assessment of noise level in the Neyveli region," Journal of Environmental Studies and Policy, **2003**, Vol 2, no.1, pp 1-13.
[3] USDOT. 1995 " Highway Traffic Noise Analysis and Abatement Policy and Guidance," Federal Highway. Administration, Office of Environment and Planning, Noise and Air Quality Branch, Washington DC.
[4] Dora, C.A. "A different route to Health: Implication of Transport Policies," British Medical Journal 1999, Vol 7, pp 1686-1690.
[5] Briggs, D.J, de Hoogh. K., Morris, C. and Gulliver,. "Effects of Travel Mode on Exposures to Particulate Air Pollution," Environmental International, Vol.34, pp 12-22, Jan. 2008.
[6] Belojevic, G., Jakovljevic, B., Stojanov, V., Paunovic, K. and Ilic, Jan. 2008. "Urban Road- Traffic Noise and Blood Pressure and Heart Rate in PreSchool Children," Environmental International, Vol. 34 ,pp 226-231.
[7] Clark C, Martin, R, van Kempen, Alfred, ., Head, J, Davies, H.W, Haines, M.M, Barrio, I.L., Matheson, M. and Stansfeld, S. "Exposure-Effect Relations between Aircraft and Road Traffic Noise Exposure at School and Reading Comprehension-the RANCHI Project," American Journal of Epidemiology, Vol.163, pp 27-37, Aug. 2000.
[8] Hyder A. A., Ghaffar, A.A., Sugerman, DE., Masood, T. I. and Ali, L.. "Health and Road Transport in Pakistan," Public Health, Vol. 120, pp 132-141, 2006.
[9] "Central Pollution Control Board. Noise pollution Regulation in India," CPCB New Delhi, 2001.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY