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Noise Monitoring & Model Validation of Commercial & Industrial Area of Faridabad

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ABSTRACT
This paper purpose is monitoring of noise level at various sites of industrial & commercial area of Faridabad. Statistically analysis of both monitored results & noise calculated by prediction noise models & through regression analysis check validation of calculated noise by some defined prediction models & designed prediction noise models. By sound level meter, observed Leq is monitored from 15 samples in a hour & how many vehicle's like as Bus, Truck, Bike, Auto, Car, Jeep passing at a every selected location is monitored in morning & afternoon times in continuous 4 days(selected location 60 samples each is taken). As well as road width is measured, % of heavy vehicles, % of light vehicles & other's vehicle's no's feed into prediction noise models & calculated Leq. Comparison is drawn between observed Leq, Standard noise, Lmin, Lmax, Lavg & calculated Leq of prediction models. Statistically analysis of prediction models Leq & Observed Leq. Observed monitored results shows that Leq in Industrial & Commercial area is greater than ambient noise standards. Reason of high noise is very large no. of vehicles passing on present road width. Industrial morning& afternoon time the average difference between the average value of Burgess, Josse, Fagoti & Peretti prediction models L_{eq} is -14.69 dB(A), -13.43 dB(A), -20.35 dB(A), and -14.75 dB(A)&is -21.25 dB(A), -19.69 dB(A), -24.47 dB(A), and -25.62 dB(A). Commercial in morning & afternoon time is -10.9 dB (A), -9.53 dB(A), -14.72 dB(A), and -11.62 dB(A)&-21.44 dB(A), -19.00 dB(A), -23.06 dB(A), and -20.11 dB(A). Prediction noise models (Burgess, Josse, Fagoti, Peretti) validation shows calculated Leq are very less than observed Leq New designed prediction models A for Industrial morning time, B for Industrial afternoon time, Similarly C for Commercial morning time & D for Commercial afternoon time is designed & check validation. Model D shows result that Calculated Leq is equal to observed Leq with average difference for A model is +1.95 dB(A), B Model is -6.79 dB(A), C Model is + .81 dB(A) & D Model is - 3.26 dB(A). These models can be applied for noise calculation & this model public can use & take countermeasures to prevent health problems.
KEYWORDS: Industrial area, Commercial area, Equivalent noise, Noise monitoring,

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I. INTRODUCTION

Noise pollution is a big concern today and everybody is effecting from this & it is a part of environment. Due to this no. of health diseases are spreading among the peoples now days. Noise is a unwanted & undesirable sound. Noise is a cause of no. of factor's like urbanization, industrialization, increase no. of vehicles' on road, increase no. of barkers on road, large no. of autoricksaw on road, not follow the lines by some vehicles like autoricksaw on road, jams, intersection points. During passage of time not control measures still taken to control the noise as per past designed conditions and peoples are not aware about. According ambient noise standards noise is defined in industrial, commercial, silence & residential area in day & night time to control noise pollution but still these measures are not sufficient to control noise. Noise pollution in urban cities are more as compared to rural cities. & reason of noise is all these factors as discussed above. Also when listen noise then in our mind first comes high noise but do not know how much noise is safe for us & also not know about how we can measure it. When go in google then we find we requires sound level meter & varieties of sound level meters displayed & don't know which one to choose & not understand the specification & also they are costly. Then ignore these noise levels & facing this noise pollution everyday & also not know which control measure to take & never demand to govt. for control measures. Also for sound level meters & android phones requires investment of money so ignore it. So designing a prediction model that requires no money & no skill to run & anybody can easily find accurate noise levels & can plan control

measures for himself & demand to govt. bodies or administrative staff for noise reduction measures. Model design by using practical parameters which Urban planner can considers for noise reduction design in new or old projects. Noise monitoring & model validation is a very big subject. The scope of present study is to analyses noise measurement of industrial & commercial area of Faridabad & analyses this to the noise pollution rules of India so that future constructive solution can be prepared & authorities use these models for the benefit of peoples of city.

The main objectives of the paper are:

i) Monitoring of noise levels at various Industrial & Commercial zones of Faridabad.
ii) Statistical analysis of monitored results through regression analysis & using Microsoft excel designing of new prediction models.
iii) Validation of new prediction models.

II. METHODOLOGY:-

Methodology describes the processes chosen for completing the work studied. Start from selection of area, instruments, site locations, time periods for monitoring to t-test for model validation.

2.1 Selection of studied area:- Industrial & commercial area of Faridabad is selected for day & afternoon time monitoring of noise for comparing observed noise to Lmin, Lmax, ambient noise standards. 13 locations are studied for 4 days. Noise level is measured by sound level meter i.e observed noised Leq.

Faridabad is the most industrialized city in the State of Haryana & Faridabad Division and District 28 Degrees are between 10'50'N and 28°29'04 " latitude and 77 degrees 06'49"E and 77°33'23"Light longitude. It has a geographical area of 742.90 square kilometers. Faridabad District and Division is located on South-Eastern part of the State. Its dense shape located in the south of Delhi is made in the NCR west border of Gururgram district and eastern areas of Uttar Pradesh state. The District Palwal is located in the south.

2.1.1 Selected Locations Of Industrial & Commercial Areas

1) Industrial Area Sec-25 Faridabad 121004,Haryana, India

Sites	Latitude	Longitude
Suraj industrial corporation	28.326286	77.304397
Sadhu auto part pvt ltd	28.333080	77.302647
Avery chowk	28.337960	77.302812
Metals India	28.332315	77.305970
Hanuman Mandir (NearOswal casting)	28.337447	77.305739
Near SD auto	28.333097	77.306534

2) Commercial area of Ballabhgarh & sec-11 of Faridabad 121006, Haryana, India.

Sites	Latitude	Longitude
Raja nahar singh metro station	28.339791	77.316445
Nahar singh market	28.340527	77.317673
Panchayat bahwan ballabgarh	28.341497	77.320148
Ambedkar chowk ballabgarh	28.339226	77.305978
Akash cinema ballabgarh	28.336374	77.320901
SRS shoping mall	28.386901	77.316735
Eldeco station 1 mall	28.387016	77.314032

2.2 INSTRUMENT FOR NOISE MONITORING & CALCULATED Leq NOISE PREDICTION MODELS:-

Lutron make Sound level meter, SL-4010 is selected for noise monitoring. The features of sound level meter are 3.½ Digit 18mm (0.7") LCD. Range : 30 ~ 130 dB, 3 ranges. 1st Range - 30 ~ 80dB, 2 nd Range - 50 ~ 100dB, 3rd Range - 80 ~ 130dB, 50dB on each step, with over and under range indicating. Resolution : 0.1dB. Accuracy : 23 + 5oC. Frequency : 31.5Hz ~ 8,000Hz.

Fig. 2.1 Sound level meter

For Calculated Noise Selection Of Prediction Noise Models & Parameters:-

Following parameters for calculating Leq for noise like as (P) Percentage of heavy vehicles (%),(W) Road Width (m), (Nm)Number of motorcycles per hour, (Q)Total number of vehicles per hour,(Nc) Number of light vehicles per hour, (Nb)Number of buses per hour, (Nh) Number of heavy vehicles per hour, L=W.

Burgess (Leq) = 55.5 +10.2 log Q + 0.3p −19.3log (L / 2) -----(i)

Josse (Leq) = 38.8 +15logQ −10log L----------(ii)

(Fagoti (Leq) = 10log (Nc + Nm + 8Nh + 88Nb) + 33.5----------(iii)

Peretti (LAeq,) = 38.8 + 10log(1.5Nm+Nc+6Nh)----------(iv)

2.3 Data Monitoring Procedure

In a hour 15 samples for a particular locations continuous to four days (60 samples for one location) & average for each selected location in industrial & commercial area is monitored in morning & afternoon time in gap of 4 minutes for noise. At All sites road width is measured & other parameter are monitored like as Bus, Truck, Bike, Auto, Car, Jeep quantity is measured by passing a selected location Then calculate percentage of heavy vehicles & light vehicles. The monitoring procedure has been summarised below:

Sr. No.	Site	Location	Monitoring Dates	Monitoring Time	No. of Samples
1.	Site 1	Suraj industrial corporation	22-04-2019 to 25-04-19	06:00am-07:00am 06:00pm-07:00pm	30*4=120
2.	Site2	Sadhu auto part pvt ltd	22-04-2019 to 25-04-19	07:00am-08:00am 07:00pm-08:00pm	30*4=120
3.	Site 3	Avery chowk	22-04-2019 to 25-04-19	0:800am-09:00am 08:00pm-09:00pm	30*4=120
4.	Site 4	Metals India	22-04-2019 to 25-04-19	09:00am-10:00am 09:00pm-10:00pm	30*4=120
5.	Site 5	Hanuman Mandir (NearOswal casting)	22-04-2019 to 25-04-19	10:00am-11:00am 10:00pm-11:00pm	30*4=120
6.	Site 6	Near SD auto	22-04-2019 to 25-04-19	11:00am-12:00am 11:00pm-12:00pm	30*4=120
7.	Site 7	Raja nahar singh metro station	15-04-2019 to 18-04-19	06:00am-07:00am 06:00pm-07:00pm	30*4=120
8.	Site 8	Nahar singh market	15-04-2019 to 18-04-19	07:00am-08:00am 07:00pm-08:00pm	30*4=120
9.	Site 9	Panchayat bahwan ballabgarh	15-04-2019 to 18-04-19	0:800am-09:00am 08:00pm-09:00pm	30*4=120
10.	Site 10	Ambedkar chowk ballabgarh	15-04-2019 to 18-04-19	09:00am-10:00am 09:00pm-10:00pm	30*4=120
11.	Site 11	Akash cinema ballabgarh	15-04-2019 to 18-04-19	10:00am-11:00am 10:00pm-11:00pm	30*4=120
12.	Site 12	SRS shoping mall	15-04-2019 to 18-04-19	11:00am-12:00am 11:00pm-12:00pm	30*4=120
13.	Site 13	Eldeco station 1 mall	15-04-2019 to 18-04-19	12:00am-01:00pm 12:00am-01:00am	30*4=120

Table 2.1: Data monitoring procedure

2.4 DATA ANALYSIS PROCEDURE

(i) Noise monitoring:- Avearge of Standard. Leq, Lmin, Lmax & Lavg is taken. Comparison is done.

(ii). Prediction models (Burgess, Josse, Peretti & Fagoti) running model procedure:-

These models works on the parameters w, P, Nm,Q, (Nc), Nb), (Nh). All sites road width is

measured & other parameter are monitored like as Bus, Truck, Bike, Auto, Car, Jeep. Then calculate percentage of heavy vehicles & light vehicles. Then put this value in model parameters & calculated noise is resulted.

(iii) Designing of New Model Equation:- With the help of Microsoft excel & regression analysis selected all these parameters for previous running models. Regression analysis results into new equation parameters after which selected new model equation is designed that suite for Indian conditions. All previous models running parameter when we enter in new designed model equation new calculated Leq is resulted. Again comparison is made between stand. Leq & Leq value.

III. RESULTS AND DISCUSSIONS

Ambient air noise monitoring standard noise is 75 dB(A) but Industrial area found in morning Lavg is 75 dB(A), Lmin is 63 dB(A), Lmax is 87 dB(A) and Leq is 90 dB(A). & evening Lavg is 73 dB(A), less than ambient air noise monitoring standard. Lmin is 60 dB(A), Lmax is 87 dB(A) and Leq is 94 dB(A). And as Leq value is recorded more than the standard value. Reason is more vehicular traffic as shown in fig. 2 & 3.

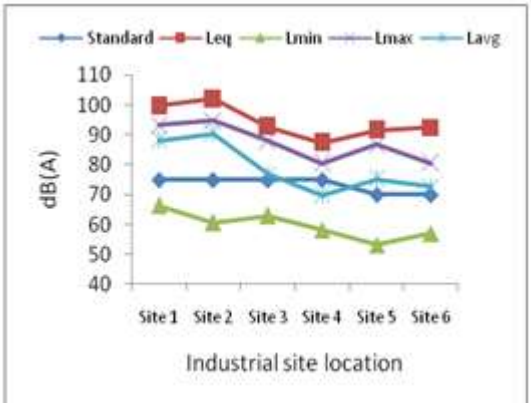

Fig.2 Industrial afternoon time

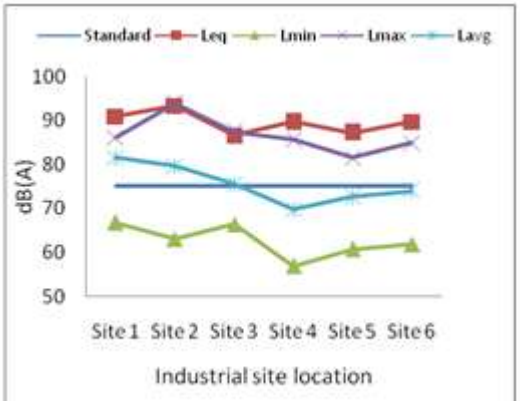

Fig.3 Industrial morning time

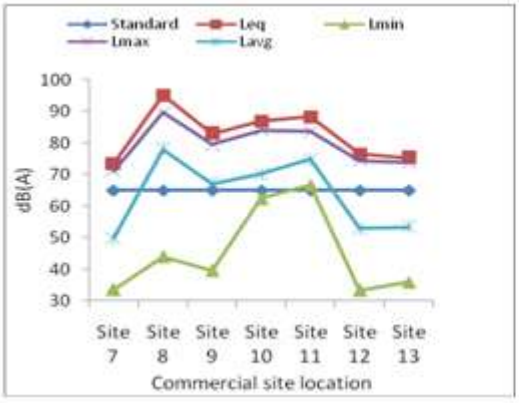

Fig.4 Commercial morning time

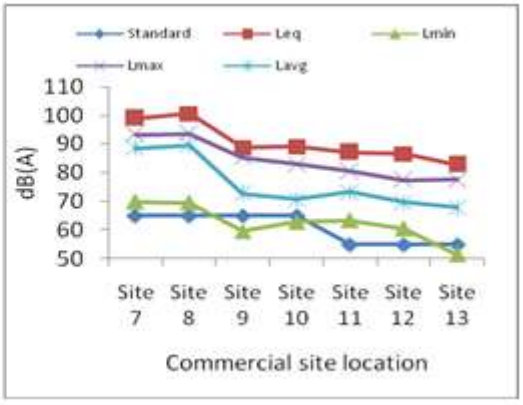

Fig.5 Commercial afternoon time

Ambient air noise monitoring standard is 65 dB(A). But Commercial area Ballabhgarh & sec-11 Faridabad in morning time noise recorded Lavg is 64 dB(A), less than standard. Lmin is 45 dB(A), Lmax is 80 dB(A) and Leq is 83 dB(A) and for evening standard is 65 dB(A) & 55 dB(A) recorded Lavg is 76 dB(A), greater than standard, Lmin is 62 dB(A), Lmax is 84 dB(A) and Leq is 91 dB(A) and as Leq value is recorded more than the standard value. Reason is more vehicular traffic & narrow roads as shown in above fig. 4 & 5.

Industrial area Prediction models calculated leq results found at the same site in morning & evening times from the fig. 6 & 7 shows average value of Burgess, Josse, Fagoti & Peretti Models L_{eq} is -14.69 dB(A), -13.43 dB(A), -20.35 dB(A), and -14.75 dB(A. For afternoon time average value of Burgess, Josse, Fagoti & Peretti Models L_{eq} is -21.25 dB(A), -19.69 dB(A), -24.47 dB(A), and -25.62 dB(A).

Commercial area Prediction models calculated leq results found at the same site in morning & evening times from the fig. 8 & 9 shows average value of Burgess, Josse, Fagoti & Peretti Models L_{eq} is -10.9 dB(A), -9.53 dB(A), -14.72 dB(A), and -11.62 dB(A).

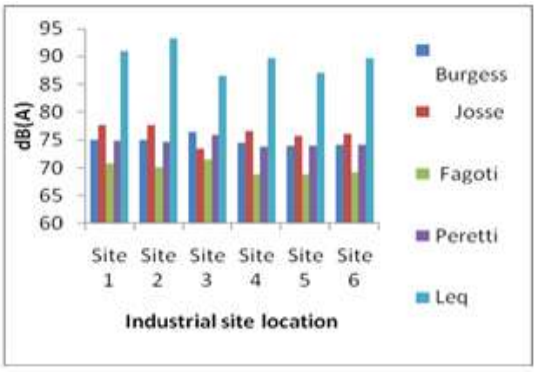

Fig.6 Industrial morning time

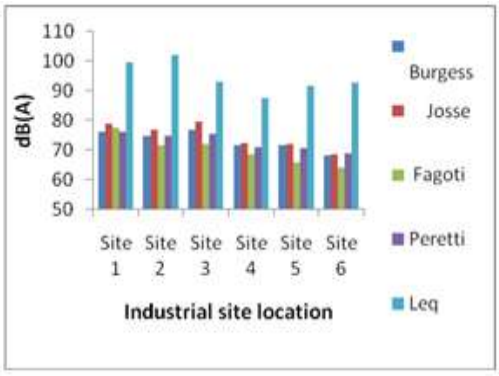

Fig.7 Industrial afternoon time

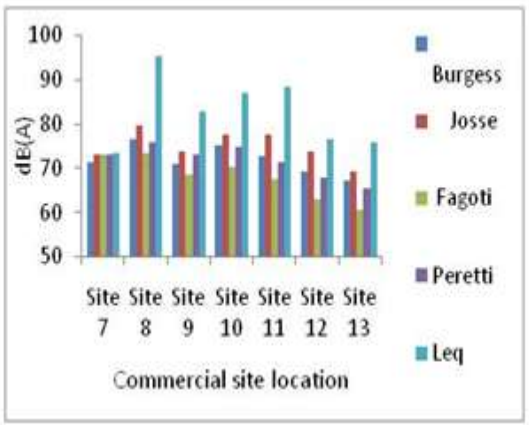

Fig.8 Commercial morning time

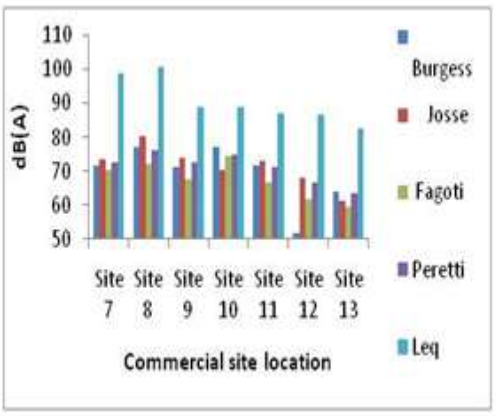

Fig.9 Commercial afternoon time

For afternoon time average difference between the average value of Burgess, Josse, Fagoti & Peretti Models L_{eq} is -21.44 dB(A), -19.00 dB(A), -23.06 dB(A), and -20.11 dB(A). Results shows that Burgess, Josse, Fagoti & Peretti noise calculated models are not suitable for Indian conditions. So designing of new model. **Using regression analysis** & Microsoft excel design new model equation for industrial morning, afternoon, commercial morning & commercial afternoon that gives approximately equal results as observed Leq results.

Industrial Area Morning time & Afternoon time **New Model (A) Leq**=62.55-P(65.95)+Q(.02)-Nm(.045)+Nh(.146)-Nb(.605)+12--(v) **New Model (B) Leq**=707.83-P(2591.25)+q(.54)-Nc(1.49)+Nm(.867)+Nb(11.14)----(vi) Commercial Area Morning time & Afternoon time **New Model (C) Leq**= 83.380+P(176.51)-w(1.33)-Q(.352)+Nc(.370)-Nm(.011)+Nb(.566)---(vii) **New Model (D) Leq**= 42.85-P(188.65)+W(4.67)-Q(.014)+Nm(.0007)-Nb(1.76)----------(viii)

Station Name	Timing	Leq	New Model (A)	Timing	Leq	New model (B)
Suraj industrial corporation	6.00-7.00 am	90.893	87.28	6.00-7.00 pm	99.65	88.89
Sadhu auto part pvt ltd.	7.00-8.00 am	93.29	91.49	7.00-8.00 pm	101.95	93.75
Avery chowk	8.00-9.00 am	86.54	78.46	8.00-9.00 pm	92.78	80.1
Metals India	9.00-10.00 am	89.64	91.33	9.00-10.00 pm	87.37	83.6
Hanuman Mandir (Near Oswal casting)	10.00-11.00am	87.13	87.94	10.00-11.00pm	91.6	88.11
Near SD auto	11.00-12.00pm	89.66	88.99	11.00-12.00 pm	92.44	90.62
	AVERAGE	89.53	87.58	AVERAGE	94.30	87.51
	VARIANCE	6.14	22.95	VARIANCE	29.65	24.21
	STD. DEVIATION	2.26	4.37	STD. DEVIATION	4.97	4.49

Table 2.1 results of calculated Leq of Model &B.

Station Name	Timing	Leq	New Model (C)	Timing	Leq	New model (D)
Raja nahar singh metro station	6.00-7.00 am	73.52	74.08	6.00-7.00 pm	99.03	86.4
Nahar singh market	7.00-8.00 am	95.17	96.82	7.00-8.00 pm	100.6	99.17
Panchayat bahwan ballabgarh	8.00-9.00 am	82.97	83.76	8.00-9.00 pm	88.75	89.59
Ambedkar chowk ballabgarh	9.00-10.00 am	87.02	88.5	9.00-10.00 pm	89.02	82.01
Akash cinema ballabgarh	10.00-11.00 am	88.38	89.06	10.00-11.00 pm	87.01	84.9
SRS shoping mall	11.00-12.00 am	76.59	76.92	11.00-12.00 pm	86.57	86.53
Eldeco station 1 mall	12.00-1.00 pm	75.8	75.98	12.00-1.00 am	82.77	82.36
	AVERAGE	82.78	83.59	AVERAGE	90.54	87.28
	VARIANCE	62.61	70.32	VARIANCE	44.57	34.28
	STD. DEVIATION	7.33	7.76	STD. DEVIATION	6.18	5.42

Table 2.1 results of calculated Leq of Model C&D.

Validity of New model (A), New model (B), New model (C) & New model (D from table 2.1 & 2.3 shows that that there is no difference between the measured value and calculated value of L_{eq}. The average difference between the average value L_{eq} is -1.95 dB(A), + 6.79 dB(A), +.81 dB(A), and -3.26 dB(A the standard deviation is 4.37, 4.49, 7.76 & 5.42.

New model C gives very accurate result as observed from sound level meters.

IV. CONCLUSIONS

The New model A, B,C & D suggested in equation (v), (vi), (vii),(viii) gave better results as compared to Burgess, Josse, Fagoti & Peretti Models in equations (i), (ii), (iii), (iv) for calculating L_{eq}. & Observed Leq in industrial & commercial area of Faridabad found more than the prescribed permissible limit. Noise calculated from road width & vehicles monitoring parameters shows that due to continuous increasing no. of vehicles'. Measure noise by applying New models & plan for control measures.

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