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PREDICTION OF TRAFFIC NOISE LEVEL OF LUCKNOW CITY BY USING CORTN MODEL

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Abstract: People's health and wellness are impacted by traffic noise, which is gaining more public attention. For the purpose of assessing traffic noise in various nations several traffic noise prediction models have been developed. In traffic noise modeling, the noise level at a receptor position caused by a source of traffic emissions is typically modeled as a function of the traffic conditions (i.e., traffic volume, traffic composition, and traffic speed), road gradient, nature of the road surface, percentage of absorbent ground cover, street configuration, and distance between the source of traffic emissions. The receiver. The source of traffic emissions can be thought of either a point or a line source. Traffic noise models making an assumption federal highway in the United States are among the pollution sources. Traffic Administration The influence of traffic noise on people's health and wellbeing is becoming increasingly widely recognized. Several traffic noise prediction models have been created to evaluate traffic noise in various countries. In traffic noise modeling, the noise level caused by a source of traffic emissions at a receptor position is typically modeled as a function of the traffic conditions (i.e., traffic volume, traffic composition, and traffic speed), road gradient, type of road surface, percentage of absorbent ground cover, street configuration, and distance between the source of traffic emissions. The recipient. One possibility for the source of traffic emissions is a line source or a point source. Models for traffic noise assuming. In the United States, federal roadways are among the sources of pollution.
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Keywords: Noise, traffic emissions

I. Introduction:

A human or piece of equipment may sense sound, which is a mechanical vibration made by an elastic medium (such as air and water) that provides the pressure moving the particles. Sound's properties give it meaning. According to the combination of pressure (Pascal, Pa) and frequency (Hertz, Hz), sound has mechanical vibration. The "level of sonorous pressure" (sometimes known as the "intensity" or "loudness") of a sound is quantified in decibels (dB) (Anees, et al., 2017). It is a unit of measurement used to indicate, on a logarithmic scale, the ratio of one value of a power or field quantity to another logarithmic number is referred to as the power level or field level, as appropriate. Regarding decibel scale, the faintest sound that can be heard (near complete 0 dB corresponds to absolute quiet. One may define sound.

In a study titled "Status of Ambient Noise Level in India, 2017," the Central Pollution Control Board claims. One of the most prevalent contaminants is noise. A musical clock could be enjoyable to listen to during the day but annoying at night while you're trying to sleep. Noise is defined as "sound without value" or "any noise that the recipient does not want to hear." The Latin term for nausea, which also means seasickness or, more broadly, any equivalent feeling of disgust, aggravation, or discomfort, is whence the word "noise" from. The typical definition of noise is unwanted sound pollution that causes unfavorable physiological and psychological outcomes in a person, by interfere with social activities, such as Work, relaxation, fun, sleep, etc. A noise might be disliked due to its loudness and unpleasantness. The term "noise pollution" describes noises produced by humans that endanger the health or wellbeing of nearby people and animals. Air pollution that includes environmental noise poses a risk to the health and welfare of all living things. Because of population expansion, urbanization, and the ensuing rise in the usage of increasingly potent, diverse, and highly mobile sources of noise, it is more severe and pervasive than ever before, and it continues to expand in scale and gravity (Sonkar et al., 2014). There are two different sorts of noise sources. Pollution pollutants both indoors and outside. Radio, television, generators, electric fans, air coolers, air conditioners, various household equipment, and family disputes are among the indoor sources of noise. Loudspeakers used carelessly, industrial processes, autos, train traffic, airplanes, and events like market gatherings, religious, social, and cultural events, sporting events, and political rallies are some examples of outside sources. Farm equipment and pump sets are the primary causes of noise pollution in rural regions. Use of firecrackers at holidays, weddings, and several other events contributes to noise pollution. But noise pollution is a problem city because of the large concentration of transportation, industries, and population activities. Like other contaminants, noise pollution an outcome of industrialisation, Urbanization and contemporary culture. Daytime is defined as 6 AM to 10 PM, while nighttime is defined as 10 PM to 6 AM. A silence zone is described as a radius of up to 100 meters around locations like courts, hospitals, and educational institutions. The responsible authorities must declare them. The competent authority may designate mixed categories of regions as one of the four aforementioned categories. The goal of the current study is to assess the average sound levels in several study areas, including Lucknow city, in order to determine the state of ambient noise levels and, subsequently, to determine the ensuing contamination from environmental noise.

II. Resources and Techniques

The CORTN Model. The CORTN model's computation makes the assumption that there will be normal circumstances for traffic and noise propagation, which are consistent with moderately unfavorable wind speeds and directions during the designated times. The fundamental hourly noise level at a receiving site with a reference distance of 10 meters from the nearside road edge may be computed using.

Basic = 42,2 plus 10log10q,

where q is the total amount of heavy and light vehicle traffic per hour and Basic is the average hourly noise level. Here, it is assumed that the source line is 3.5 meters from the nearside roadway edge and that it is 0.5 meters above the carriageway; see Figure 1.The basic traffic speed on the road, the proportion of heavy vehicles, and the road grade are all assumed to be 0% in (1)'s computation of the basic noise level. Applying the correction for the proportion of heavy trucks and real mean traffic speed.

ΔLPV = 33log10(V + 40 +500V) + 10log10(1 +5PV)− 68.8,

where V is the mean traffic speed that depends on road classification as specified by CORTN model and P is the percentage of heavy vehicles given by

P =100f/q, where f is the hourly flow of heavy vehicles. The traffic speed V in (2) depends on the road gradient.

For a nonzero road gradient, traffic speed will be adjusted by

ΔV = [0.73 + (2.3 −1.15P100)P100]G, (4)

where G is the road gradient. As a result, ΔLPV in (2) can be expressed as

ΔLPV = 33log10(V+ ΔV + 40 +500(V + ΔV))+ 10log10(1 +5P(V + ΔV)) − 68.8.

The adjustment of basic noise level for road gradient ΔL

G

is given by

ΔLG= 0.3G.

Subsequently, the corrections to the basic noise level are added to take into account the effects of distance from the source line, the nature of the ground surface, screening fromany intervening obstacles, and reflections frombuildings an fac¸ades. The distance correction can be calculated by

ΔLD= −10log10(d□13.5)

where d is the shortest slant distance from the source

position given by d= √(d + 3.5)2+ h2, d is the shortest horizontal distance between the nearside carriageway edge and the reception point, and h is the vertical distance between the source position and the reception point.The shortest horizontal distance d is assumed to be not less than4m.

The correction for ground cover can be calculated by

ΔLGC=5.2Ilog10(3(d + 3.5)) for H < 0.75

5.2Ilog10((6H − 1.5)(d + 3.5)) for 0.75 ≤ H <(d + 5)

60 for H ≥(d + 5)6

where *H* and *I* are, respectively, the mean height and the proportion of absorbing ground between the edge of the nearside carriageway and the segment boundaries leading to the reception point.

In the CoRTN method, the reflection correction is calculated by

$$\Delta LF = 2.5 + 1.5(\theta\square\theta)$$

where the correction of 2.5 dB(A) is to take into account the reflection of noise from facade adjacent to the reception point

(or on the nearside of the reception point), 1.5($\theta\square/\theta$) dB(A) is the correction for reflection from opposite facade facing the reception point, $\theta\square$ is the sum of the angles subtended by all the reflecting facades on the opposite side of the road facing the reception point, and θ is the total angle of view at the reception point.

III.Results and Discussion:

III.1 Noise Levels:

Table 1.The ambient noise standards of different types of zones being followed in India.

Area	Night Time (L_{eq} **dB(A))**	Day Time (L_{eq} **dB(A))**
Commercial Area	55	65
Residential Area	45	55
Industrial Area	70	75
Silence Zone	40	50

III.2 Field Study

A study was done to assess the noise levels now in place, its effects on the environment, and the possibility for continued urban growth. Ambient noise levels were measured in several places, including calm regions, busy areas, and residential and commercial zones, that were selected based on the type of land use. This study's primary objective was to evaluate the amount of noise in urban and semi-urban settings, hence the locations were picked to represent different zoning types that may be found in urban areas, such as residential, commercial, calm, and heavy traffic zoning. Details on the chosen locations are provided in Table 2.

Table 2. Locations chosen for prediction of noise.

Locations	**Type of zones**
Govt. Polytechnic, Engineering College, Madiyaon	Residential Zone
Gole Market, Chowk	Commercial Zone
Medical College Hospital(KGMC)	Sensitive zone
Charbagh,Alambagh,Amausi ,Sachivalya	Heavy Traffic Zone

With the study's objectives in mind, a field data collection program was developed to collect data on the following parameters, including: the current noise level, traffic's categorized volume and speed; geometric criteria, such as the width of the road, the number of lanes, the lane width, the shoulder width, the presence and width of the median; the presence and breadth of the pedestrian walkway; and the specifics of roadside developments.It is crucial to consider the following longitudinal section characteristics, including the distance between a receiver point and the intersection, the use of the nearby land, the presence of bus stops, and other elements that might affect the smooth flow of traffic, in addition to other details like the nature and state of the road.

The movement of vehicles was essentially unimpeded. The basic noise data was gathered by placing the noise level meter 1.2 meters above the ground.

The reported noise levels for each site were input into an excel sheet and computed.

The average traffic speed and volume statistics for each location were also compiled in an Excel spreadsheet, and the appropriate values for the distance and speed correlations were computed using the given equations for each correlation.

Table 3. Total Traffic Volume at different locations

Time	Charbagh	Alambagh	KGMC	GOVT.Polytechnic	Madiyaon
8:00-9:00 am	3290	3140	3679	3712	3762
9:00-10:00	4230	4130	4359	4423	3256
10:00-11:00	3290	3258	3478	3210	3345
11:00-12:00	3279	2145	2334	2450	4569
12:00-1:00 pm	3489	3789	2671	2310	5678
1:00-2:00	4351	3634	4456	4569	3312
2:00-3:00	3785	2134	3257	3490	3985
3:00-4:00	3869	2256	3289	6840	4209
4:00-5:00	3921	2387	3340	5903	4003

5:00-6:00	5698	5624	3901	5730	4012
6:00-7:00	3690	3498	4120	3121	5689
7:00-8:00	4320	2367	4018	3590	5629

Table 4. Total traffic volume at different locations

Time	Chowk	Thakurganj	Gole Market	Polytechnic	Engineering College
8:00-9:00 am	3190	2140	3379	3789	3349
9:00-10:00	4930	3230	4059	4408	3201
10:00-11:00	3890	3058	3178	3210	3323
11:00-12:00	4579	2045	2134	2420	4545
12:00-1:00 pm	3679	3689	2671	2320	5601
1:00-2:00	4401	3234	4056	4530	3367
2:00-3:00	3215	2034	3057	3412	3905
3:00-4:00	3409	2156	3209	6811	4203
4:00-5:00	3901	2187	3311	5945	4034
5:00-6:00	5098	5024	3998	5732	4023
6:00-7:00	3210	3498	4123	3101	5604
7:00-8:00	4340	2167	4245	3556	5689

Observed and Cortn computed Leq values for each lattice have been regressed, and the regression coefficient R2 has also been used to evaluate the performance of the design.

Table 5..Measured and Predicted traffic noise levels at Roadside

S no.	Locations	Measurement dB(A)	CORTN Prediction dB(A)	Difference dB(A)
1	Thakurganj	78.60	77.13	-1.47
2	Polytechnic Chauraha	76.80	76.09	0.71
3	Chowk	78.80	79.17	0.37
4	Gole Market	76.80	77.14	0.34
5	Medical College	77.60	76.54	-1.06
6	Charbagh	79.20	79.34	0.14
7	Hussainganj	79.20	79.18	-0.02
8	Alambagh	79.20	79.10	1.70
9	Quisebagh	77.40	73.57	-0.83
10	Vikas Nagar	74.40	77.01	0.01

Table 6.Measured and Predicted traffic noise levels at Roadside

Receptor	Height above sound Source (m)	Measurement dB(A)	CORTN Prediction dB(A)	Difference dB(A)
1	3.1	74.20	73.45	-0.85
2	5.2	74.00	74.99	0.99
3	6.8	73.40	74.19	.79
4	9.0	72.80	72.89	0.09
5	10.6	72.80	72.62	-0.18
6	12.4	71.80	72.98	1.18
7	14.2	72.60	71.30	-1.30
8	16.0	70.00	70.75	0.75
9	17.6	71.40	72.28	0.88
10	20.0	71.80	70.03	-1.77

Table 7..Contains the correlation equation that was determined between the computed and b-served leg values.

Locations	Equations	R^2 value
Thakurganj	Y=1.8956X-10.789	0.612
Polytechnic Chauraha	Y=1.6576X-31.721	0.741
Chowk	Y=1.8134X+12.789	0.851
Gole Market	Y=1.8056X+25.789	0.792
Medical College	Y=1.8121X+11.789	0.709
Charbagh	Y=1.9156X-70.129	0.714
Hussainganj	Y=1.4356X-18.789	0.677
Alambagh	Y=1.3456X+11.678	0.786
Quiserbagh	Y=0.5156X+14.789	0.655

Vikas Nagar	Y=0.1156X-17.789	0.668

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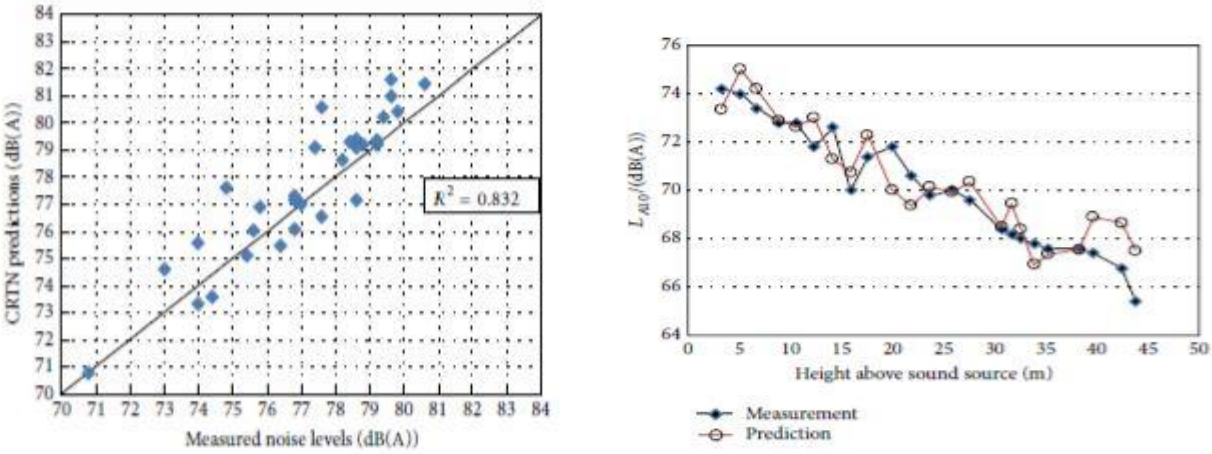

Fig 1. Measured and Predicted traffic noise levels.

It is observed as calculated R2 values ranges from 0.60 to 0.85 and CORTN Model is best for Implememted for prediction of noise in Lucknow City.

IV.Conclusions:

1.Pecentage variation between observed and predicted noise levels ranges from 5.89 to 12.24

2. From the observed values of traffic noise ,it has been observed that the noise level exceeded at all the identified locations and is significantly higher than the standards prescribed by Central Pollution Control Board(CPCB) for different land uses.

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