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Noise Level Assessment for an Upcoming International Airport

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Abstract: ***Noise pollution is the excessive noise that may harm the activity or balance of human being. The sources of the most noise worldwide is mainly caused by atmospheric noise/environmental noise/occupational noise such as industrial machines, transportation systems and indoor noise generated by machines (particularly in some workplaces), building activities, domestic appliances and music performances etc. The main purpose of this study is to assess the impact and effect of noise emitted by traffic on the various links in the surrounding areas of an upcoming international airport. This study presents on site noise level measurement at 10 locations situated at 10 Km. radius from the Airport Reference Point (ARP) and on the various links around the airport. Noise monitoring was carried out at all locations for 24 Hours (Leq) in residential, commercial, Industrial and silence zone located in the surrounding areas of Kushinagar (U.P.) (India) airport during December-March 2017. FHWA model has been used for the prediction of noise level. The results show that noise pollution on various links are higher than the prescribed limits given by CPCB.***

Key Words: Airport Noise, FHWA Model, CORTON Model, Noise Pollution Index, Traffic Noise Index.

I. INTRODUCTION

In this universe of quick urbanization, we are always in the scope of activity Commotion (Noise). Activity Noise is of incredible worry to the general population living close to the sides of the interstates. Nobody on earth can get away from the hints of Noise an undesirable, exasperating sound that causes an aggravation subjective depending on each person's preferences. Noise is an unsettling influence on the human condition that is heightening at such a high rate, to the point that it will end up being a noteworthy danger to the nature of human lives. In the previous thirty years, Noise in all zones, particularly in urban regions, have been progressively quickly. There are various consequences for the human condition because of the expansion in Noise contamination.

An ordinary element of our life is Commotion (Noise), it methods for correspondence and excitement in many creatures, including individuals. Sound which crosses as far as possible is named as Noise. The word Commotion (Noise) originates from the Latin word "noxia" signifying "harm" or 'hurt'. A Commotion (Noise) is characterized as an undesirable sound that is at an unlucky spot which bringing about sentiment uneasiness (Carter, 1996). It is one of the ecological contaminations with which we are experienced in day by day life and by and large disregard. Sound is measured in decibel (dB) unit. Noise is one of the guideline territory of movement exceptionally air and street transport and it for the most part goes unpriced (Thangadurai et al, 2005). It is additionally a to a great degree fruitful alert framework. A low stable is to a great degree satisfying where as a noisy sound is unpleasable and is ordinarily alluded to 'Commotion (Noise)'. Din is the hugest criteria which change over sound into Noise. Noise can be characterized as unpleasable and undesirable sound. It is a corporal type of contamination and is not specifically hurtful to life supporting frameworks i.e. air, soil and water. Its exasperates straightforwardly to the recipient i.e. man.

Commotion (Noise) from Aircrafts and from movement going to and from airstrip is presumably the clearest natural effect of the flight business since it is effortlessly seen and irritating, particularly where this happens regularly. Aircraft Commotion (Noise) is produced by both the motor and the airframe and is most obvious amid landing and take-off and underneath much of the time utilized flight ways. Different wellsprings of Noise incorporate Commotion (Noise) produced from maneuvering air ships, the utilization of switch push (a discretionary braking help on landing), motor tests and on location vehicular activity. Additionally, Commotion (Noise) effects can have stretched out to vehicular and rail movement to and from the airstrip, and development Noise.

Aircraft Noise is Commotion (Noise) contamination delivered by any air ship or its segments, amid different periods of a flight; on the ground while stopped, for example, assistant power units, while navigating, on keep running up from propeller and stream debilitate, amid departure, underneath and sidelong to takeoff and entry ways, over-flying while on course, or amid landing.

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A. Noise (Commotion) Index

It is expected that Day-Night Average Sound Levels (DNL) should be utilized to know the sound introduction on individuals/occupants because of flying machines and for land utilize arranging around airplane terminals.

Day-Night Average Sound Levels (DNL) is the Energy-Averaged Sound Level (Leq) measured over a time of 24 hours, with a 10-dB punishment connected to evening time (10:00 PM and 6:00 AM) sound levels to represent expanded inconvenience amid the night hours.

Add up to Day-Night Average Sound Levels, Background Day-Night Average Sound levels and Event Day-Night Average Sound Levels should be resolved at areas around airplane terminals is specified beneath:

1) Total Day-Night Average Sound Levels (TDNL) TDNL = 10 Log 10(1/T) [∑ 10 (LA, eq, d, i /10) + Σ 10 (LA, eq, n, i + 10)/10]

2) Event Day-Night Average Sound Levels (EDNL) EDNL = 10 Log 10(1/T) [∑ 10 (LA, eq, d, i /10) + Σ 10 (LA, eq, n, i + 10)/10]

3) Background Day-Night Average Sound Levels (BDNL) BDNL = 10 Log 10(1/T) [∑ 10 LA, eq, d, i /10) + Σ 10 (LA, eq, n, i + 10)/10]

Where,

LA, eq, d, i = Equivalent Sound Level, for one second, in day time (6 AM to 10 PM), measured with slow response and A-weighted filter, in Db LA, eq, n, i = Equivalent Sound Level, for one second, in night time (10 PM to 6 AM), measured with slow response and A-weighted filter, in dB T = Total time beneath consideration, in seconds

B. Study Area

Kushinagar, Kusinagar or Kusinara is a town and a Nagar Panchayat in the Kushinagar area of the Indian condition of situated around NH-28 and is 52 km east of Gorakhpur city. It is an essential Buddhist journey site, where Buddhists trust Gautama Buddha accomplished Parinirvana after his passing. Outside India, it is an International Buddhist Pilgrimage Center.

The airplane terminal is arranged with a runway of 3200 M with parallel runway intended to suit the open-air Noise level.

TNI ought to be computed for Daytime and Nighttime period utilizing the condition as given beneath:

TN = 4 (L10-L90) + **L90-30**

The Commotion (Noise) proportional level (Leq) ought to be measured constantly at each checking locales utilizing sound level meter Model. The sound level meter ought to be set 1.2 to 1.5m over the ground level and no less than 3m far from sound reflecting sources like dividers and so forth in the open-air condition.

Figure: Satellite image of Kushinagar airport

The think about region appeared in Figure covers the region around the airplane terminal falling inside the span. The consider range is additionally separated in two sections to be specific center region and periphery region of 10 km. The center territory covers the region inside the range of 10 km, in which all the scooped natural parameters have been examined to comprehend the extent of effect. In the rest of the range i.e. periphery range spots of verifiable significance, feel, social including naturally touchy have been considered.

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C. Selection Of Monitoring Stations

Noise quality monitoring stations were selected based on different noise generating sources and type of receptor environment in the project area. The list of the sites is given in table 1. The Leq was measured at each monitoring sites using sound level meter model (Bruel and Kjaer, Denmark 2232). The sound level meter was placed 1.2m – 1.5m above ground level and at least 3m away from the wall. The device was placed in the direction of the source of the sound emitter the mic facing perpendicular to the flow of the traffic. The sample was taken for 10minutes in every hour from mid hour pass 25 minutes to 35 minutes.

Table 1: Ambient quality monitoring stations

S. No.	Name of Stations
1.	Narainpur
2.	Misrauli
3.	Madari Patti
4.	Parsahwa
5.	Hanuman Mandir
6.	Madaraha
7.	Parsauni
8.	Budhha Temple
9.	Kasia Bus Station
10.	NH-28

D. Noise Modeling

1) *Federal Highway Administration Model (FHWA):* The Federal Highway Administration Model (FHWA) predicts hourly Leq for free-flowing traffic conditions. The Federal Highway Administration's Environmental policy includes a commitment to ensure that all mitigation measures are incorporated into project to minimize the noise impacts and enhance the environment through prudent application of FHWA. The adjustment is made for total traffic flow, the actual distance of receiver from the road, the extent of road segment, type of ground cover, shielding of source of sound and the gradient of road.

Leq = 10 Log 10 ∑ 10^(Leqi/10)

{Leqi = Lo + Avs + AD+ AS}

{Avs = 10 * Log 10 (Do * Q/SF) – 25}

{AD = 10 * Log 10 (Do/D) 1 + α}

Where,

;lLeqi = Hourly equivalent for each vehicle type

Lo = The Reference energy mean emission level.

Avs = Volume and speed correction for subscribe.

AD = Distance correction

AS = Ground cover correction

Q = volume for each category (vehicle/hr.).

SF = speed (km/hr.) for FHWA model.

Do = reference distance (m) taken as 10m

D = distance of measurement from Centre of each lane. α = Ground cover coefficient.

2) *Calculation of Road Traffic Noise Model (CORTN):* This model was first introduced in the year 1988 in UK. In this model, basic noise level is measured at 10 m away from the carriageway edge is obtained from traffic flow, the speed of the traffic, the composition of the traffic, the gradient of the road and the type of ground surface (Bhattacharya C.C et al, 2002)

L10 = L0c + AMP + AD + AG + AB + AGR + AV

Where,

L10 = Basic noise level.

AMP = mean traffic speed and percentage of heavy vehicle correction.

AD = Adjustment in distance (m).

AG = Adjustment in gradient.

AGR = Adjustment in ground cover.

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AV = Adjustment in view angle correction.
AB = Adjustment in barrier.

II. RESULT AND DISCUSSION

The results show that all the stations where the data was obtained exceed the permissible limits. FHWA model shows the equivalent noise levels which we compared with the measured equivalent noise levels. CORTN prediction model shows the highest predicted noise levels. Traffic flow should be monitored, and speed limits should be set in the concern areas which will help in controlling the noise levels. Although the noise levels at all the stations are higher than the prescribed noise limits by CPCB. At Kasia Bus Station (commercial capital of Kushinagar) shows the highest Leq because of traffic jams, blow of horns and the background noise is also high. It is the main business place and thus has highest traffic volume of vehicles running on the roads. It is well monitored by traffic police, but traffic gets jam and the honking of horns makes it terrible for the people nearby. Thus, alternative routes of communication must be taken for minimizing the noise levels in the carriageway at Kasia Bus Station. At Buddha Temple, it is a tourist place and a spot of attraction for the people travelling for pilgrimage places. The roads are narrow and so the use of horns in peak hours affects the noise conditions. The use of loud-speakers for social activities at this place contributes to high peak sound level. At NH, the noise levels are constant throughout the day and lower levels are seen in the morning hours.

Table 2: Comparison between the Equivalents at Kasia Bus Station

Time	Measured Leq	FHWA prediction	CORTN prediction
08-09 hr.	71.18	66.18	71.44
09-10 hr.	75.99	67.57	73.01
10-11 hr.	87.09	68.02	74.02
11-12 hr.	92.65	68.70	75.05
13-14 hr.	91.70	68.40	75.27
14-15 hr.	88.67	67.97	74.74
15-16 hr.	85.83	67.82	74.70
16-17 hr.	93.12	67.46	73.24
17-18 hr.	96.21	67.95	73.91
18-19 hr.	89.38	67.24	74.08
19-20 hr.	83.06	65.88	73.71

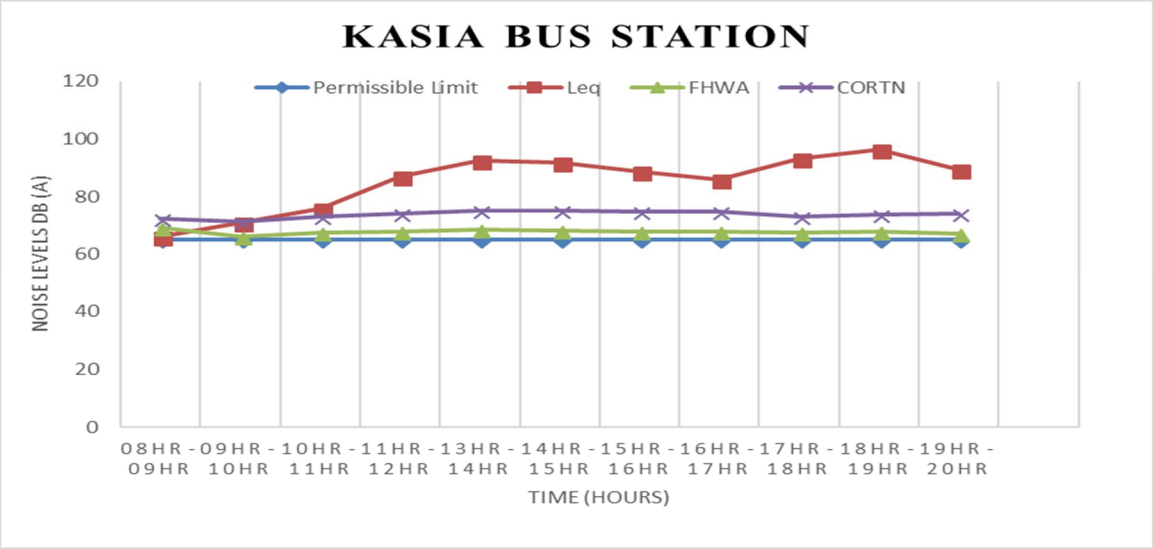

Figure: Graph shows the comparison between different equivalent

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III. CONCLUSION

A. The analysis of collected data shows that all the stations where the data was obtained exceed the permissible limits.
B. FHWA model shows the equivalent noise levels which we compared with the measured equivalent noise levels.
C. CORTN prediction model shows the highest predicted noise levels.
D. Traffic flow should be monitored, and speed limits should be set in the concern areas which will help in controlling the noise levels.
E. Although the noise levels at all the stations are higher than the prescribed noise limits by CPCB.
F. In the analysis of traffic noise, the noise levels show drastic increase in noise level with higher flux rate.
G. All the values of noise levels both measured and predicted exceed the prescribed limits.
H. Noise is a type of pollution which can neither be seen nor be smelled which distinguish is from other types of pollution.

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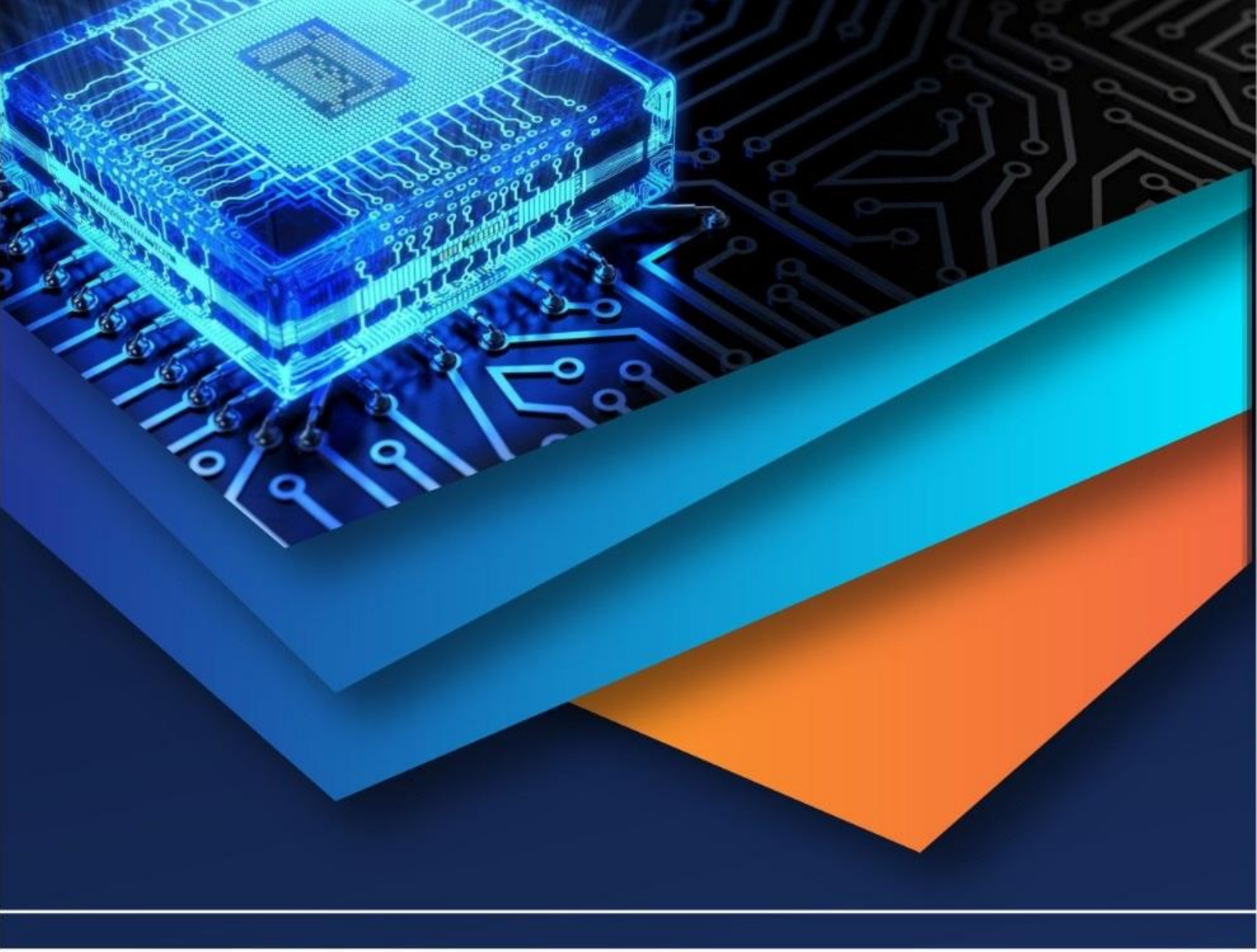

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