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Case Study of Traffic Noise Level and Feeding the Same into Simulation

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***Abstract*—Traffic noise produces unpleasant or disturbing sounds to the communities, which not only makes enormous noise pollution in the road areas but also effect the living and occupational quality of the buildings and land located near the main roads and highways. Due to increase in the urbanization, the number of vehicles has increased rapidly as a result of this there is an increase in traffic noise. As traffic noise is one of the major contributors of environmental noise pollution. Noise can damage physiological and psychological health of human being. Noise pollution can cause annoyance, aggression, and hypertension, high stress levels, hearing loss and sleep disturbances. The main purpose of this project is to analyze the road traffic noise at IGM area in Agartala, the capital city of Tripura and to check whether the noise levels are within the prescribed ambient levels or not. Again the following scenario was created in SiMTraM, simulation software of Traffic and at a certain point for a time interval few vehicles were noted and their sound behavior throughout the stretch was found out. As the capital city is growing rapidly and due to development without proper planning it have led to traffic congestion particularly at different road intersection and in roads which causes huge amount of noise as the drivers normally keep the engines of their vehicle on and unnecessary blow horns. Due to above ill effects of noise pollution there is need for analyzing the traffic noise in the city as the traffic noise is increasing in the city day by day. In this study various highway noise descriptors (equivalent continuous sound pressure level (Leq), maximum and minimum sound pressure level (Lmax and Lmin) etc. and traffic volume are found out for analyses of noise**

Keywords*— *SiMTraM, Equivalent continuous sound pressure level (Leq)

I. INTRODUCTION

Sound is the vibration in the air that reach our ear whereas noise is the unwanted sound or excessive sound .Increase in urbanization in cities and increase in traffic volume are the factors which are responsible for the noise pollution due to traffic . Motor vehicle, a significant symbol of modern civilization, not only brings convenient transportation to our society but also gives off unpleasant traffic noise in living environments.

Agartala, capital of Tripura with a population of 399,688 as per census 2011 is the second largest city of north east, after Guwahati both in municipal area and population. Many divisional offices, educational facilities, business and shopping centers, temples, stadiums etc. are located here. Thus city plays an major role in economic development of not only in Agartala region but also the entire Tripura state.

A. Highway Noise Descriptors

1)Equivalent Continuous Sound Pressure Level: L_{eq} [1], [2] represents a value known as Equivalent Continuous Sound Level. Usually the sound pressure level (SPL) you are measuring varies in amplitude over time. L_{eq}, on the other hand, is the imaginary constant SPL that would produce the same energy as the fluctuating sound level you are measuring over a given time interval.

$$L(eq) = 10\log_{10}\left(\sum_{i=1}^{i=n} 10^{\frac{Li}{10}} * ti\right)$$

Where
L_{eq} = equivalent continuous sound pressure level in dB
n = total number of sound pressure levels recorded
L_i = values of sound pressure recorded in dB with i= 1, 2, 3……n
t_i = time duration of different sound pressure levels expressed as a fraction of the total measuring or recording time.

2) Ln Concept

The parameter LN represents the sound pressure level (or noise level) that will be equaled or exceeded for N% of the measuring time. The variations in the emission of noise levels in a particular environment can be assessed from the statistical distribution of noise levels in that environment to draw a statistical distribution curve, terms like L10, L50 and L90 play an important role.
The Sound levels exceeding 10%, 50% and 90% of the total time intervals during a particular period are designated as L10, L50and L90 respectively. For example, an L10, 1h level of 65 dB means that for 6 minutes in that hour (10% of time) the noise level exceeded 65 dB and rest of time it was less than 65 dB L90 represents the noise level exceeded for 90% of the time and it is often used to describe the background noise level.

A. Methods For Evaluating Road Noise

CIDAUT has developed a methodology for measuring and evaluating road traffic noise

*1) Statistical Pass By Method (SPB):*The method involves the measuring of traffic noise from acertain height and distance from the edge of pavement or from the center line of road.

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2) Close Proximity Method (CPX): Noise level measurement are done with microphone placed close to the test tyre mounted on a vehicle so that the test produce the real conditions. Noise between the road surface and tyre is measured.

II. OBJECTIVE OF WORK

In this study the object is to analyze the noise created by traffic or the traffic noise in Agartala city and to aware the habitants about the effects of noise pollution.

The objectives of the study are summarized as follows:

- Measurement of noise intensity (or loudness) at different important locations in Agartala city during morning, afternoon and evening.
- To compare the results with Central Pollution Control Board (CPCB) for noise specification.
- To show the interdependence relation between traffic flow and traffic noise created by the vehicles.
- To simulate the same volume of traffic in SiMTraM and find out the trend of harmonoise created by vehicles at stretch of their travel.

III. METHODOLGY

Statistical Pass By Method (SPB) was adopted for measuring the noise.

A. Location

Traffic volume and noise levels were measured at IGM "*Fig.1*", in the month of August – mid October 2015.

Fig .1 Location of IGM road- Agartala city (courtesy Google-earth)

B. Data Collection

Road traffic noise level monitoring duration was 6hrs from (9:00am-3:00pm) so, as to get peak and non-peak traffic hours. For data collection each hour was divided in 6 intervals of 10 minutes duration and samples were collected at an interval of 2 minutes. Thus, total 30 sets of sound-pressure level data were recorded in peak and non- peak traffic hours which were used to compute equivalent continuous sound pressure level for one hour duration (Leq (1hr)).

C. Monitoring Of Traffic Volume

Traffic volume was monitored simultaneously while monitoring noise level using a digital camera. Hourly traffic count was calculated by analyzing the video footage taken during field observation.

D. Measuring Instrument

The sound level meter (SLM) was placed over tripod stand at an average height of 1.5 m from the ground level and at a distance of 2 m from the pavement edge with its microphone pointing towards the noise source. The sound level meter of Tenmars Electronics Co. Ltd. Taiwan (IEC 61672 TYPEII) is used. The time constant used for the sound level meter was ''slow'' as the noise is level is unsteady and may vary in an irregular way over the period of time. Relatively steady sounds are easily measured using the "fast" response Frequency weighting was set as " A" Measurement range " medium" 50dB-100dB was selected.

TABLE I. INDIAN STANDARD FOR AMBIENT NOISE LEVEL

Area Code	Noise Limit In dB(A)	
	Day Time	*Night Time*
Silence Zone	50	40
Residential Zone	55	45
Commercial Zone	65	55
Industrial Zone	75	70

IV. SIMULATION

SiMTraM is the extension of SUMO for heterogeneous traffic developed by IIT Bombay, India. SUMO is a microscopic road traffic simulation package. In the near future it will be extended to model other transit modes simultaneously with ordinary car traffic. In SiMTraM harmonoise can be found out of each vehicle. A route file consisting of exactly the same number of vehicles accounted in real world scenario and same proportion vehicles were run, then at a point at every 20 seconds vehicles were noted and their trend of harmonoise emitted were noted down. The trend is shown in "*Fig.2*",Again to create the simulation the following files had to be written and they are the .nod file,.edge file,.net file,.typ file,. flow file,.vtype file,.rou file,.cfg file.

A. Node File

```
<nodes>
<node id="A" x="0.0" y="0.0" type="priority"/>
<node id="B" x="50.0" y="0.0" type="priority"/>
<node id="C" x="100.0" y="0.0" type="priority"/>
<node id="D" x="150.0" y="0.0" type="priority"/>
</nodes>
```

B. Edge File

```
<edges>
<edge id="1" fromnode="A" tonode="B"
priority="" nolanes="2" speed="70"/>
</edges>
```

C. Type File

```
<types>
<type id="f" priority="2" nolanes="2"
numstrips="7" speed="60.333"/>
</types>
```

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D. Net File

The net file we will get after netconvert.

E. Flow File

<flow id="0" from="1" to="3" begin="0" end="1000" no="2012" type="distrib1" />

F. Vtype File

<routes> <vtypeDistribution id="distrib1">

<vtype accel="3.5" decel="2.8" id="bike" length="1.87" maxspeed="27.77" guiShape="motorcycle" stripWidth="1" probability="0.497"> <carFollowing-Krauss sigma="0.0" tau="1.0" /> </vtype>

<vtype accel="3.5" decel="2.8" id="car" length="4" maxspeed="25.0" guiShape="taxi" stripWidth="2" probability="0.198"> <carFollowing-Krauss sigma="0.0" tau="1.0" /> </vtype>

<vtype accel="2.5" decel="1.5" id="3w" length="3.2" maxspeed="19.44" guiShape="delivery" stripWidth="2" probability="0.29"> <carFollowing-Krauss sigma="0.0" tau="1.0" /> </vtype>

<vtype accel="1.2" decel="0.9" id="bus" length="10.1" maxspeed="19.44" guiShape="bus" stripWidth="4" probability="0.015"> <carFollowing-Krauss sigma="0.0" tau="1.0" />

</vtype> </vtypeDistribution>

</routes>

G. Route File

Using MOVE software the route file is created

H. Cfg File

This is the configuration file where the inputs and the required outputs were written and then runned in SiMTraM.

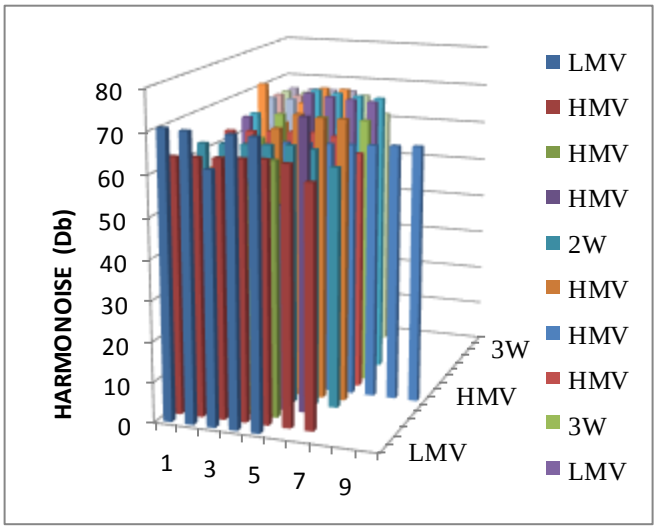

Fig.2: Trend of harmonoise by vehicles

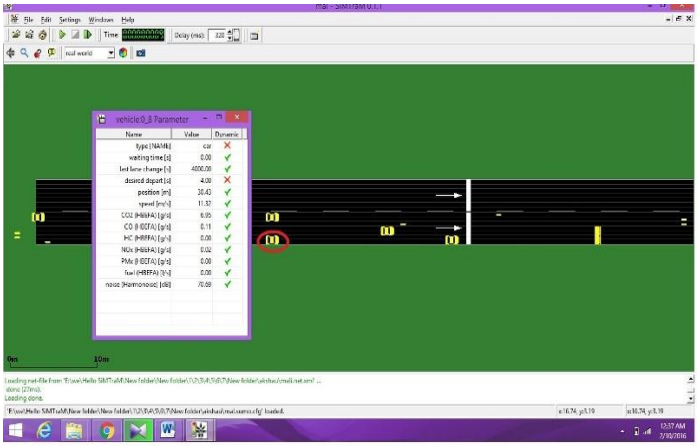

Fig3: Screenshot of SiMTraM

V. CONCLUSION

IGM is one of the silence zone of Agartala city.The hourly average noise levels Lmax and Lmin for daytime are ranged from (89 to 93.7) dB(A) and (67 to 70.2) dB(A) (Table 2). The hourly average noise levels Leq for daytime varied from (78.8 to 82.8) dB (A) which is more than permissible limit of silence zone of 50dB (A) *"Fig.4"*. And it was also observed that as the volume (number of vehicles/ hr.) increased the noise level also increased (Table2).The trend of harmonoise for each vehicle extracted from the simulation as seen from the bar graph*"Fig.2",* shows that at certain points the noise level for each vehicle is high and the HMVs and LMVs made more noise compared to 2 wheeler and 3 wheelers.

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SOUND PRESSURE LEVEL dB(A)							
06/08/2015 (THURSDAY)	*Lmax*	*Lmin*	*L10*	*L50*	*L90*	*Leq*	*volume*
9:00-10:00AM	98.3	69.3	85.5	74.2	70.6	84.9	1740
10:00-11:00AM	94.3	68.9	88.6	73.8	69.8	78.2	1547
11:00-12:00PM	90.2	68.2	86.1	74.4	69.3	80.4	1612
1:00-2:00PM	96.7	66.5	85	73.1	67.5	83.9	1685
2:00-3:00PM	98.3	68.2	87	74.7	69.3	85	1748
7/08/2015 (FRIDAY)							
9:00-10:00AM	89.4	66.6	84	75	69.8	79.4	1530
10:00-11:00AM	96.7	68.9	88.4	74	69.8	84.3	1670
11:00-12:00PM	94.6	66.5	86.8	74	67.5	83	1655
1:00-2:00PM	98.3	68.6	85.3	73.9	69.9	85	1680
2:00-3:00PM	89.1	68.2	86	74	69.3	80	1550
10/08/2015 (MONDAY)							
9:00-10:00AM	92.3	76.9	86.3	80.9	77.1	81.3	1685
10:00-11:00AM	86.3	70.9	82.9	74.8	71.2	79.5	1610
11:00-12:00PM	85	62.4	80.8	71.3	67.5	78.2	1570
1:00-2:00PM	86.3	70.9	83	74.8	71.3	78.4	1594
27/08/2015 (THURSDAY)							
9:00-10:00AM	89.1	68.2	86	74	69.3	80	1610
10:00-11:00AM	96.7	69	83	75	69.2	83.5	1630
11:00-12:00PM	86.3	70.9	83	74.8	71.3	73.7	1426
1:00-2:00PM	96.7	68.2	86.9	74.8	68.8	84.1	1646

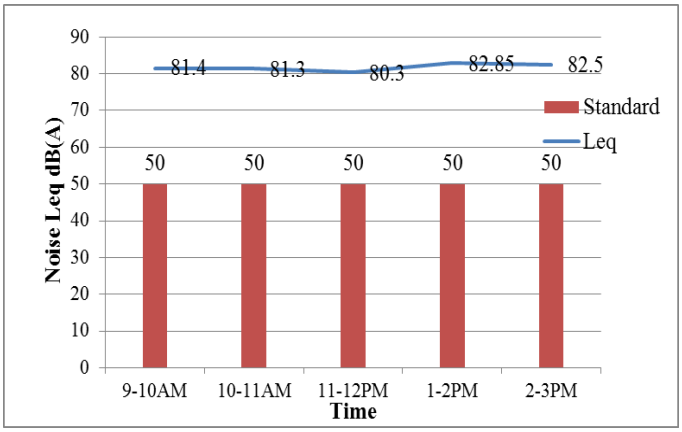

Fig4: Bar chart showing hourly variation of Noise Leq dB(A) with standard level at IGM

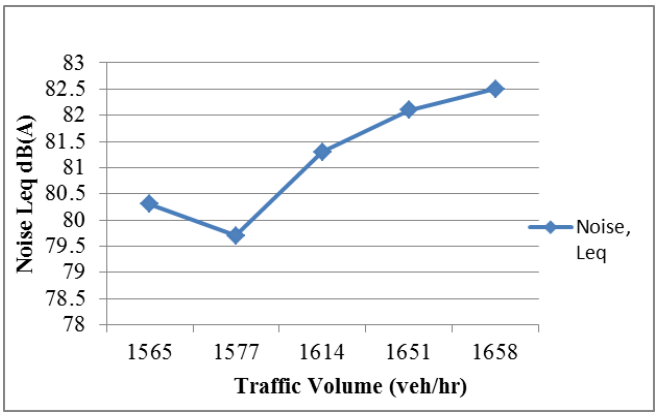

Fig5: Noise Leq dB(A) variation with volume (veh/hr) at IGM

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