NOISE REDUCTION USING CONCRETE BARRIERS: A CASE STUDY

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Abstract. Noise pollution is becoming more and more acute, and hence many researchers are studying the noise attenuation effect and prevention of noise. In this study an attempt has been made to find the reduction in noise levels at National Highway 45 near peerkankaranai in Chennai. Two sensitive places were selected along NH 45 by examining attenuation of noise by providing noise barriers in the form of concrete structures.

The primary goal of this project was to identify innovative design of noise barrier that has the potential to be implemented in NH 45, Chennai. Based on the research and evaluation conducted for this study, it was recommended that two innovative barrier designs be implemented in Chennai. First, a noise prediction is made at the specified location on the highway under certain traffic conditions in order to determine the noise level by measurement and decide on the barrier requirement. The installation of sound barriers is feasible enough to cause a significant decrease in noise pollution at the roads. Considerable noise attenuation is achieved by providing concrete noise barrier.

The paper provides Leq at the time of traffic data recorded was 105.1 dBA at NH45 and 91.108 dBA at NH5 during the time of observation at installation of barrier the values are 70.09 dBA 79.11 dBA, respectively. Noise reduction is possible and noise reduction is predominantly reduced by providing barrier.

Keywords – noise pollution, measurement, barrier, atténuation, mitigation

Introduction

People experience the ill effects of sound contamination consistently. As one of the four significant contaminations on the planet, sound contamination lessens the nature of the metropolitan climate and human wellbeing. It has been assessed that around 80 million individuals (roughly 20% of the populace) locally experience the ill effects of commotion levels considered unsatisfactory, i.e., over 65 dB (decibels) in purported "dark territories", while an extra 170 million individuals are living in "hazy situations" presented to sound levels somewhere in the range of 55 and 65 dB (1).

Discoveries from a huge assemblage of studies show that traffic sound causes non-examiners' pressure impacts like changes in the physiological frameworks, e.g., raised circulatory strain, different intellectual shortfalls, e.g., poor supported consideration, memory/fixation issues, rest unsettling influences, psychosocial stress aggravation as expressed by (2).
The establishment of sound walls is adequately doable to cause a huge lessening in commotion contamination at the streets. This investigation will at that point dissect what the impact of boundaries mean for the sound power level at the streets. To do as such, sound level produced by a traffic streaming in an open stream is contrasted with that of a streets furnished with sound wall. In light of the mathematical outcomes and graphical portrayals, an inside and out discussion is done to examine the viability of introducing the hindrances.

The principle objective of this paper is to anticipate the sound weakening after the establishment of the sound wall out and about side. The need of this venture is to decide if the establishment of sound walls is adequately achievable to cause a particular abatement in commotion level at the streets by (3).

**Need for barriers**

It is habitually important to utilize methods that lower the degree of commotion out and about side or at source. An assortment of strategies is accessible for sound decrease yet they can be essentially assembled as follows: inactive and dynamic mediums.

Dynamic mediums contrast from aloof mediums in that it is important to apply outer energy in the commotion diminishing interaction. The retaining materials, all things considered, are inactive mediums that lower commotion by dispersing energy and transforming it into heat (4).

The commotion anticipation can be explored as stated (6).

1. Noise barriers
2. Thin layer surfaces (dense)
3. Facade insulation of dwellings
4. Vehicle noise limits for type approval
5. Porous road surfaces (single and double layer)

On considering the above commotion hindrances are fundamental important to lessen sound or constrict commotion. Commotion boundaries are commonly developed of cast set up cement or brick work block in specific zones, where space permits and soil material is accessible, earth embankments are built as sound hindrances.

The hindrances successfully lessen commotion levels, yet regularly cause bothersome auxiliary effects, like hindered perspectives on houses, obstructing the section point for houses, front facing view, picturesque highlights, diminished deceivability from the street, enormous shadows cast across an inhabitant's front yard and terrace for broadened times of the day.

Raising sound boundaries to accomplish further commotion decrease regularly compounds these auxiliary effects (7). Imaginative sound boundary plans and medicines have been effectively executed in different nations for various years.

These inventive plans have permitted the development of a commotion divider as a conventional divider. A portion of the creative materials and plans that have been investigated and utilized in different locales incorporate straightforward boards, semi-clear substantial materials, acoustical medicines, and extraordinarily planned top medicines, like bended or calculated tops, sporadic top edges, or T-top medicines. Large numbers of these plans enjoy their own benefits and inconveniences (8).

This examination paper manages one such obstruction: arrangement along the street side to discover the sound levels decrease at NH 45 segment; two touchy spots were chosen along NH 45. In the current examination a commotion hindrance which is of substantial square was utilized. This comprises of two kinds.

One is ordinary sort of substantial square of M30 blend concrete. The subsequent one is M30 blend substantial which is part of the way supplanted by coral shell powder (CSP) of 10% blend in with concrete.
Objectives
- To determine the noise pollution along the highway
- Check whether any noise attenuation is required
- Analysing the attenuation of noise by providing the noise barrier

Study Area

The NH 45 (Grand southern trunk) a place located at Perungalathur, Tamilnadu, India was considered. This location is paramount for all south bound movement of traffic from Chennai shown in Fig 1

![Figure 1 Perungalathur railway station and adjoining places](image)

It is a useful link from all sources of national highways across Chennai. Presently all the south bound intercity buses uses from Chennai, the headquarters of Tamil Nadu State, uses this place for alighting and boarding passengers who are transiting from Chennai city to go for down south.

Presently the traffic congestion is severe and another feature is the railway station which is located adjoining to the national highway.

Variation of noise levels due to road traffic is both spatial and temporal. The time period selected in such a way that in both the locations traffic noise was recorded conveniently and the exposure method of measurement are shown in Table 1. The table also presents the details of the sound barrier erected for the purpose of measurement.

| Sl. No. | Location | Duration | Size of the barrier provided | Ref Details | Nature of exposure |
|--------|----------|----------|------------------------------|-------------|--------------------|
| 1      | On National Highway 45 near peerkankaranai where traffic noise is reported because of all south bound buses transit here. | 2 hour | Length 1.00 m Width 1.00 m Height 0.60m | L11 Open place | L12 Shed with M30 mix concrete L13 Shed with M30 mix concrete with CSP |
| 2      |          |          |                              | L21 Open place | L22 Shed with M30 mix concrete L23 Shed with M30 mix concrete with CSP |

Equipment

An important part of noise assessment is the actual measurement of the noise levels. The ‘A’ weighted network was used as it corresponds very closely to a person’s hearing sensitivity. The noise
level at two locations were measured with the help of HTC make Sound Level Meter (3241 – c type II data logger) on a digital display type.

**Noise barrier provided**

The commotion hindrance is introduced as a rectangular shed of size $1.00 \text{ m} \times 1.00 \text{ m} \times 0.60 \text{ m}$ out and about. Figure 2 shows a schematic perspective on a commotion obstruction as a substantial shed built for both customary cement and CSP concrete at the chose areas.

**Fig. 2 Noise barrier as a shed at both locations**

**Parameters Calculated From Survey (9)**

The following noise parameters $L_{10}$, $L_{50}$, $L_{90}$, $L_{eq}$, $L_{min}$, $L_{max}$, and $L_{ave}$ were calculated. $L_{10}$, $L_{50}$, $L_{90}$ = noise level exceeded for 10%, 50%, 90% of the time in noise recording

$L_{eq} = L_{50} + (L_{10} - L_{90})^2/60$

$L_{min}$, $L_{max}$, $L_{ave}$ from data logger from sound level meter.

Nonstop $L_{eq}$ estimation during day time was completed at the two areas during September 2019. The outcomes show that the sound contamination at the spots of estimations is wide spread all through a large portion of now is the ideal time.

The sound in this space is composite in nature. After the presentation of the substantial shed there is an extensive decrease in the degree of sound inside the shed at the two areas and in the two sorts of sheds.

Other moderation estimates like public interest, instruction, traffic the board, and foundational layout assume a significant part in commotion decrease.

It was seen that the sound levels were over the principles endorsed by the CPCB (Central Pollution Control Board) Standards (Table 2) outwardly of the shed though in within the shed the decrease is impressive by about 16%.

**Table 2 Permissible noise levels**

| Sl. No | Zone     | Noise level in dba* |
|--------|----------|---------------------|
|        |          | Day time | Night time |
| 1      | Industrial | 75        | 70         |
| 2      | Commercial | 65        | 55         |
| 3      | Residential| 55        | 45         |
| 4      | Silence   | 50        | 40         |

Design, for example, room as a methods for lessening the sound levels at the recipient. The genuine distinction between the sound pressing factor levels inside and outside a nook depends not
just on the transmission loss of the walled in area boards yet additionally on the acoustic ingestion inside the fenced in area.

As present, there is no particular and nitty gritty enactment to control the commotion contamination. Notwithstanding, there is a dire need that the Central and State Governments ought to figure out how to get an enactment passed for the control of sound contamination.

Aside from such sort of Central enactment, there ought to be a city commotion control code for all significant urban areas in India. Making of superfluous commotion must be disallowed and ought to be culpable under law (10).

All the parameters are presented in Fig. 3 for both the locations.

![Fig. 3 Noise parameters for both the locations](image)

**Comparison of noise values with noise levels prescribed by CPCB**

The data collected from the survey is further compared with noise levels prescribed by CPCB and are shown in Fig. 4 for both the locations.

![Fig. 4 $L_{eq}$ - Comparison with CPCB standards at both locations](image)

**Results and Discussion**
Commotion levels recorded are contrasted and the CPCB principles. All commotion boundaries determined and are introduced in Figure 3 and Figure 4.

Results show that there is significant decrease by the arrangement of commotion obstruction. Noise decrease and the level of commotion decrease is appeared in Figure 5.

Noise level is 70.09 dBA to 74.11 dBA inside the work areas in area 1, whereas 79.11 dBA to 79.64 dBA at area 2.

Noise level is decreased inside the work areas and the decrease is appeared in Table 3.

Day to day the commotion level is expanding, this is because of number of vehicles continues expanding.

Despite the fact that the test is conveyed as a development of substantial shed there is no importance loss of sound reflection on the grounds that the substantial is plain concrete cement.

The CSP substantial gives commotion decrease of 16.64% which is equivalent to the ordinary cement.

The substantial shed as an obstruction shows that the commotion level can be diminished significantly.
The CSP substantial shows equivalent decrease of commotion as for typical cement. There will be a significant decrease in using the concrete in light of the fact that CSP is utilized as fractional substitution. The cost is diminished when contrasted with ordinary cement. The CSP will be a substitute material for concrete since now the expense of concrete raises every day. The chose territory is an appropriate area as a result of profoundly blocked spot.

Conclusions

Based on the results it is found that sound Leq is diminished from outside shed to inside shed. The rate of reduction is from 21 to 10 percent. The impact of sound in wall is exceptionally helpful in lessening the commotion. The shed as a boundary shows that the sound level can be diminished extensively as this provision as a wall to protect pollution. The chosen place is an appropriate area due to profoundly trafficked place and the severity is more. The provision of noise barrier as an enclosure found to be a suitable alternative solution for noise control measure. The noise enclosure is not reflecting noise rays since the emission is direct from the location place. Thus this study focuses with the noise reduction by way of providing a noise enclosure which is an apt technique to reduce noise. This is suitable for all the places.

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