MINI PROJECT REPORT

on

DESIGN OF A NOISE BARRIER IN VRSEC

A project report was submitted to

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ABSTRACT

In recent years, with the rapid development of highways, traffic noise has become a risk source in the environment, and noise control has attracted wide attention. As an economical and effective method, highway noise barriers were the best way to reduce traffic noise and protect residents' acoustic environment. At the same time, considering the various surroundings in selecting suitable materials (sound-reflective or sound-absorbing materials), types (such as concrete, metal, and photovoltaic noise barriers), and structures (such as vertical, T-shaped, Y-shaped, and inverted L-shaped) could greatly improve the sound reduction performance of barriers. These are solid obstructions built between the highway and the homes along a highway and are generally seen as effective means by which noise propagation can be mitigated. We aim to design a noise barrier for effective noise control in VRSEC to reduce noise pollution from vehicular traffic running on the newly constructed flyover passing through the college.

AIM & OBJECTIVES:

To design a noise barrier for VRSEC to effectively manage noise and lessen noise pollution from vehicles traveling on the recently built flyover that passes through the campus. Receivers are protected from excessive noise from vehicles by noise barriers. Although road constructions are responsible for reducing road traffic noise, noise barriers are thought to be the most practical noise abatement option.

INTRODUCTION:

Noise pollution is one of the phenomena that have to be handled in many places across the world, even though it has received less attention than other environmental issues like air and water pollution. In the last 40 years, more than 55% of the world's population has begun to live in cities, and the negative effects of transportation-related noise in general and road traffic noise in particular on society have come to light. Noise barriers have steadily acquired acceptance as a method of noise control due to an increase in studies in the field of noise science. Noise barriers are frequently used to stop noise from spreading along roads and railway lines, despite their expensive cost. Hearing loss, psychological stress, mental fatigue, irritability, headaches, hypertension, heart damage, and several other physical-biological problems, including alterations in digestion, metabolism, and blood circulation, are all associated with traffic noise. Over 130 dB (A) of noise can be lethal.

The purpose of highway noise barriers is to lessen the impact of traffic noise along the roadway. Noise barriers generally obstruct the direct flow of sound from the roadway source to the exposed receiver. The ability to reduce noise, aesthetics, constructability, cost, and structural strength against wind and seismic stresses are important factors to take into account when designing noise barriers. Acoustical factors, aesthetics, and cost all play a role in determining the height and length of a noise barrier.

Figure 1. Metal acoustic Noise Barrier

LITERATURE REVIEW:

Here are some case studies which we have gone through during our literature study.

1. In this paper noise levels on the flyover in front of Engineering College (IET Lucknow UP India) have been taken for study and a noise barrier for this location has been designed for predicted noise levels worked out using modified FHWA (Federal Highway Administration) model. This model makes use of traffic data like volume, speed composition, slope, ground cover, etc.

2. Construction of a flyover is often coupled with major changes in the environment. Many people in Delhi are exposed to high levels of traffic noise above the planning standards given by the Central Pollution Control Board. No Traffic Engineering improvement of a highway project is without both gains and losses. There is excessive traffic in Delhi and there is also limited scope to adopt traffic management solutions. So, in urbanized areas, the most effective reduction of traffic noise disturbances was obtained by implementing noise barriers or enclosures.

3. The study investigates the effectiveness of an existing noise wall barrier installed in a school for shielding noise from heavy traffic in Malaysia. In Malaysia studies in school, areas have been conducted since the 1980s covering west Malaysia even before the establishment of noise regulation. These include noise levels conducted in school at three schools in Klang Valley in 1985. All these selected schools exceeded the 55dB recommendation by the WHO for outdoor school areas that may affect teachers' and students' performance. It was found that the barrier efficiently achieved an insertion loss of 5 dB and above.

4. Noise levels in Egypt exceed acceptable thresholds due to the high population and lack of mandatory sound regulations. According to noise measurements done by "The National Network for Noise Level Measurement in Greater Cairo," most of the areas had shown that noise levels exceeded the standard permissible level. Noise levels reached up to 75-85dB which is considered unacceptable as noise levels should not exceed 65 dB during daytime and 55 dB during nighttime. This research revealed that the fence acts as a good noise barrier and that the combined configuration of the fence resulted in the attenuation of noise to acceptable levels.

5. To improve the sound environment along a popular esplanade in Lyon, France, a 1 m high vegetated noise barrier was erected to protect against noise from an adjacent road. The effect of the barrier was evaluated by acoustic measurements conducted before and after the barrier was erected. The barrier reduced the sound pressure level from about 67 to 62dB. The result showed that the barrier reduced road-traffic noise annoyance, and increased the overall quality of the sound environment by making it slightly calmer and slightly more pleasant.

TYPES OF BARRIERS:

1. Wood Barriers:

Wood fences are an affordable and attractive option for any garden and are common in most households. However, most wood fences are ineffective as a noise barrier due to their lack of mass, air gaps, damage, and height.

Figure 2. Wood Noise Barrier

2. Metal Barriers:

Metal barriers are impressive structures due to their modular construction. They are cost-effective and quick to install. There are absorptive options to prevent sound reflecting, whereas a non-absorptive choice can cause the sound to reflect into unexpected areas in an unpredictable manner. The benefit of steel is that it can be molded in various ways to meet specific barrier requirements.

Figure 3. Metal Noise Barrier

3. Brick/Concrete Barriers:

This is a solid long-term investment due to the material being long-lasting and extremely durable. This is why this solution exists along with the majority of highways throughout the world and many installations are decades old. However, being one of the most expensive options available this may not be an affordable option in most cases and may be an unnecessary expense based on your requirements.

Figure4. Brick/Concrete Noise Barrier

4. Glass, Polycarbonate, or Acrylic Sheet Barrier:

Acrylic and toughened glass fences obstruct the line of sight to road traffic and are mainly used to reflect sound from roads. They provide a high aesthetic benefit of glass with a long lifespan and sound absorption qualities at affordable prices.

Figure 5. Glass Noise Barrier

5. Earth Berms/ Bund Barrier:

Walls of earth, or berms, are an excellent way to reduce the amount of noise that enters your property. They can be built in a variety of ways. They are also an eco-friendly option but require considerable effort to build and can be very costly.

Figure 6. Bund Noise Barrier

METHODOLOGY:

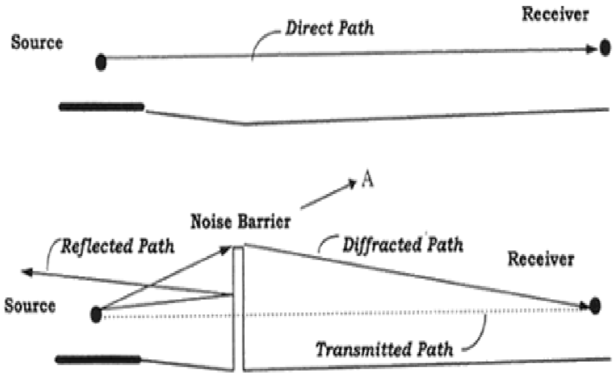


Figure 6. Guidelines on the design of Noise Barrier

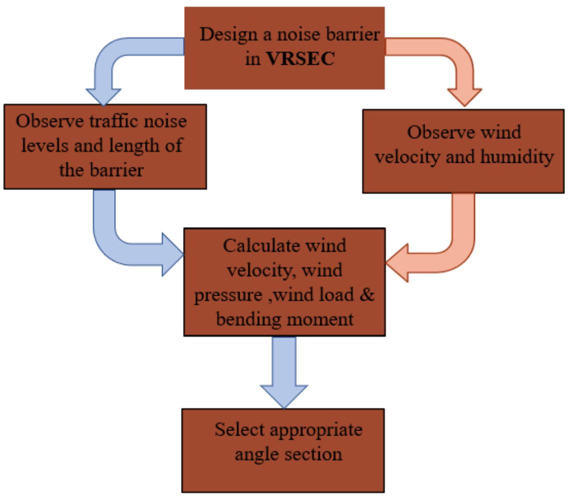
In this project, we are primarily focused on the design of the noise barrier, which is made of steel components and has connectio ns made by welding or bolting.

We research the various loads that are acting on the noise barrier during the design phase such as the wind load, gravity load, horizont al force, and bending moment.

After calculating the necessary forces and moments, we must determine the most appropriate steel section, typically an angle section, by figuring out the Section Modulus for the loads we have to determine.

We must also ensure that the obstacles are spaced properly apart. The barriers we’re installing have holes facing the vehicles on one side, and solid on the other, so that noise is absorbed into the holes and reduced on the flyover.

FLOW CHART



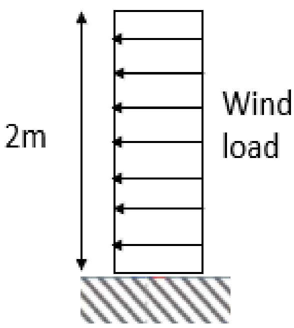
STRUCTURAL DESIGN:

Wind velocity in Vijayawada Vs=50m/s

Vd = k1*k2*k3*k4*Vs

= 1*0.91*1*1*50

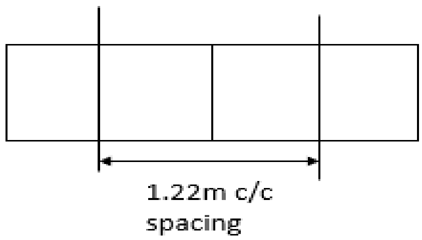
= 45.5m/s



Wind pressure = 0.6Vd^2

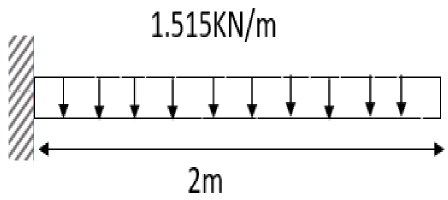
= 0.6(45.5) ^2

= 1.242KN/m^2



Wind load = 1.242*1.22

= 1.515KN/m



Bending Moment = Wl^2/2

= 1.515*2^2/2

= 3.03KNm

From bending equation:

M/I = σ/y

M = σz

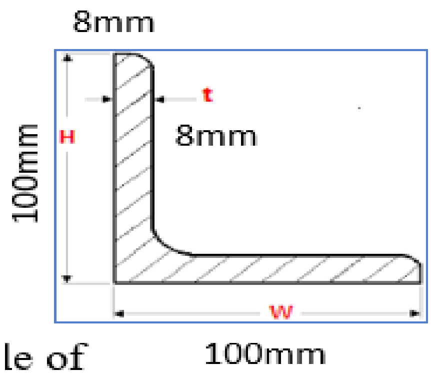
Z = M/σ

= 3.03*10^6/0.66*250

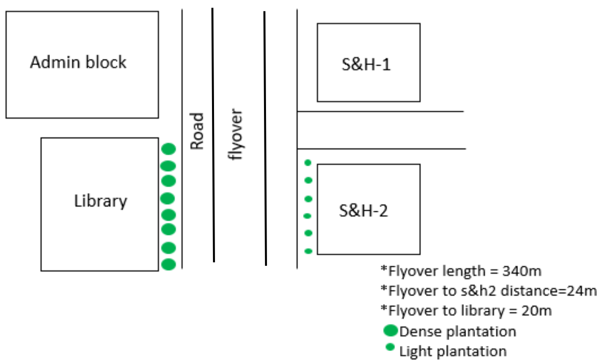
= 18.36cm^3

From steel tables:

Choosing ISA 100*100*8. The section that should be chosen is an Equal angle of 100*100*8 which can resist the wind load



As we cannot construct noise barriers at some specific areas, we prefer natural barriers (dense vegetation) to reduce the traffic noise. So, we investigated the noise reduction by natural barriers at library and S&H2 block where there is light and dense plantation.



Line Diagram

OBSERVATIONS:

S&H-2 Block (24m away from flyover):

Time (for every 15 min) (pm)	S&H-2(Ground floor)		S&H-2(First floor)	
	Max.	Min.	Max.	Min.
12:40 - 12:55	73.7	50.2	---	---
12:55 – 1:10	76.9	50.8	---	---
1:10 – 1:25	---	---	79.2	52.9
1:25 – 1:40	---	---	78.4	51.4

Table 1

On flyover w.r.t S&H-2 block:

Time (for every 15 min)(pm)	On flyover		Wind Speed (m/s)	Humidity (%)
	Max.	Min.		
12:40 - 12:55	95.2	57.6	1.6	52
12:55 – 1:10	92.8	56.5	1.6	58
1:10 – 1:25	93.4	56.8	2.3	62
1:25 – 1:40	94.1	59.6	2.1	57

Table 2

*Sound in decibels (dB)

At Library:

Time(for every 15 min)(pm)	At Library (Ground floor)		At Library (First floor)	
	Max.	Min.	Max.	Min.
3:00 – 3:15	67.3	46.7	---	---
3:15 – 3:30	59.5	46.1	---	---
3:30 – 3:45	---	---	65.8	50.2
3:45 – 4:00	---	---	66.3	49.2

Table 3

On flyover w.r.t library:

Time(for every 15 min)(pm)	On flyover		Wind Speed (m/s)	Humidity (%)
	Max.	Min.		
3:00 – 3:15	93.3	58.2	1.4	74
3:15 – 3:30	96.2	54.3	1.4	72
3:30 – 3:45	97.4	57.6	0.8	72
3:45 – 4:00	96.3	54.3	1.0	71

Table 4

RESULTS AND DISCUSSION OF ANALYSIS:

Time (pm)	On flyover	S&H-2 Block (24m away from the flyover)	On flyover	At Library (Natural Barrier)
12:40-1:40	93.8dB	77.05dB	---	---
3:00-4:00	---	---	95.8dB	64.72dB

Table 5

Table 5 depicts the comparison between the noise levels on the flyover, S&H-2 block(24m away from the flyover), and at the library with Natural noise barriers (Dense Plantation). There is a maximum noise value on the flyover when compared to the library. On flyover, it is 95dB on average but at the library, it is just 65dB.

CONCLUSION:

In our experimental study, we observed that noise levels were higher in the S&H 2 block than in the library, because of dense vegetation on the library side, which served as a natural noise barrier. These dense trees helped to reduce noise from the flyover. The presence of trees will also aid in the reduction of dust, in addition to noise barriers. According to our test data, dense trees can lower noise levels by 12 to 15 dB.

REFERENCES:

[1] Approach for Noise Barrier Effectiveness Evaluation based on In Situ "Insertion Loss" Determination by Antonio Barba and Juan M. Martinez-Orozco in 2020.

[2] Noise impact assessment due to flyovers in Delhi by Kumar, D. S. N. Venkata Amar issued in the year 2014.

[3] A case study of acoustic efficiency of existing noise barriers in reducing road traffic noise in school areas by IOP Conference Series Earth and Environmental Science in the year 2019.

[4] Case-study evaluation of a low and vegetated noise barrier in an urban public space which is a Conference paper issued in the year 2011.

[5] Assessment of Fences as Noise Barriers: A Case Study in New Cairo, Egypt by Heidy A. Mohamed, Sherif Ezzeldin, and Mostafa R. Ismail in the year 2019.

[6] Sun L, Zhao Y, Zhang J, Chen D, Zhang X. Research and application of noise barriers in highway construction. E3S Web of Conferences in the year 2019.

[7] Conference of European Directors of Roads (CEDR). Identifying the key characteristics of environmental noise barrier condition measurements. In: Practical Road Equipment Measurement, Understanding and Management Brussels, Belgium: CEDR; 2016.

[8] Schröder D, Svensson UP, Vorländer M. Open measurements of edge diffraction from a noise barrier scale model. Proceedings of the International Symposium on Room Acoustics, ISRA 2010. 29-31 August; Melbourne, Australia; 2010.