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NOISE QUALITY ENVIRONMENTAL ASSESSMENT AT SHOLINGANALLUR JUNCTION

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***ABSTRACT*:**
Road traffic is the predominant source of noise pollution in urban areas. Despite the enactment of legislation and government efforts to curb vehicular noise, the noise exposure experienced by people in India has continued to rise, primarily due to the rapid increase in vehicular population. This study aims to assess the ambient noise levels in three different zones—commercial, residential, and silent—around Sholinganallur Junction at eight specified time intervals (8:00–9:00 a.m., 9:00–10:00 a.m., 10:00–11:00 a.m., 11:00 a.m.–12:00 p.m., 12:00–1:00 p.m., 1:00–2:00 p.m., 4:00–5:00 p.m., and 5:00–6:00 p.m.).The equivalent noise levels (Leq) In all three zones were found to exceed the permissible daytime limit of 70 dB. Noise descriptors such as L_{10}, L_{90}, Leq, Noise Pollution Level (NPL), and Noise Climate (NC) were analyzed to evaluate the extent of noise pollution caused by heavy traffic. Notably, even the minimum Leq and NPL values recorded were above 60 dB and 65 dB, respectively, highlighting a significant concern regarding urban noise exposure in this area.
Keywords: *Urban Noise Pollution, Road Traffic Noise, Sholinganallur Junction, Equivalent Noise Level (Leq), Environmental Assessment, Noise Descriptors (L_{10}, L_{90}, NPL).*

I.INTRODUCTION

Sound is a form of mechanical energy that propagates through a medium such as air, water, or solid materials. It travels in the form of waves characterized by measurable parameters like frequency and wavelength. While sound plays a vital role in communication and interaction among humans and animals, it becomes a concern when it turns into noise—unwanted, disruptive, or harmful sound. Noise, particularly in urban settings, is now recognized as a significant environmental pollutant due to its adverse effects on human health and well-being.Unlike many other air pollutants such as gases or particulates that persist in the environment, noise pollution is transient in natureit ceases to exist once the source is removed. However, its health impacts, including stress, hearing loss, cardiovascular disturbances, and reduced cognitive performance, can be long-lasting.In urban environments, road traffic noise is one of the dominant sources of noise pollution. It arises from a combination of sources including the engine, exhaust, braking systems, tire-road interaction, and aerodynamic effects. Among these, tire-pavement interaction has been identified as the major contributor, especially at higher speeds. As vehicle populations increase and urbanization expands, noise levels continue to escalate, often exceeding the permissible limits set by environmental agencies.This study focuses on the assessment of environmental noise levels around Sholinganallur Junction, a rapidly developing urban area in Chennai, India. The objective is to evaluate the extent of noise pollution in different land use zones (commercial, residential, and silent zones) using established noise descriptors and compare the findings against prescribed limits to determine the severity of exposure and recommend possible mitigation strategies.

II. Literature review:

Rajamanickam and Nagan (2022) conducted a comprehensive assessment of ambient noise levels across ten major locations in Chennai, Tamil Nadu, India, with the objective of evaluating the status of noise pollution and proposing strategic mitigation measures. Their study is particularly relevant to urban junctions like Sholinganallur, where a convergence of residential, commercial, and institutional activities contributes to complex and persistent noise dynamics.

The authors employed systematic field measurements of noise levels during different time intervals in both day and night periods. The study revealed that many key locations in Chennai—including commercial and traffic-dense areas—routinely recorded equivalent continuous noise levels (Leq) exceeding the CPCB-prescribed limits for both day (55 dB in residential areas; 65 dB in commercial areas) and night (45 dB in residential; 55 dB in commercial). These findings align with broader research trends indicating urban traffic as the dominant source of noise pollution[1].This work contributes meaningfully to both the human factors and technical quality assessment domains by highlighting the need for noise-aware frameworks in remote perceptual evaluation studies. It underscores the broader implication that ambient noise not only affects physical health and comfort—as evidenced in environmental studies—but also degrades the reliability of subjective data collection, especially in urban and noisy settings. As such, the findings of Jiménez et al[2]. Experimental results demonstrated that the JND-based EST effectively filtered out participants with unsuitable environments, such as noisy surroundings or inadequate audio playback devices. This not only enhanced data quality but also reduced the variability often observed in crowdsourced Mean Opinion Score (MOS) results. Naderi et al. [3]. proposed model was tested using urban environmental datasets, demonstrating improved accuracy, robustness, and adaptability in assessing various environmental quality parameters, such as air pollution, noise levels, and urban green coverage. The GPPI approach proved effective in extracting hidden data patterns and supporting decision-making processes in urban environmental management.Xiaohu et al[4]. This model is especially relevant to urban environmental assessments like those at Sholinganallur Junction, where multiple interacting pollution factors (including traffic noise) must be considered in a holistic and adaptive decision-making context. G. Wang et al [5].The GEQES model is particularly relevant to rapidly urbanizing regions such as Sholinganallur Junction, where granular environmental monitoring and public accessibility to pollution data are essential for sustainable urban planning and citizen engagement. Wu et al[6]. The study incorporates wind flow animations into digital twin models, enabling real-time simulation and visualization of atmospheric wind patterns within urban environments. This integration aids in understanding the dynamic interactions between wind and urban structures. S.Shin et al[7]. The dataset includes recordings captured under diverse noise levels and settings, facilitating the development and testing of voice enhancement algorithms capable of operating effectively in challenging acoustic environments. Ahamed.A et al [8]. The authors developed a multi-layer neural network trained on various soil parameters, including pH levels, heavy metal concentrations, and organic matter content, to predict soil quality indices. By comparing the BP neural network's performance with traditional assessment methods, the study demonstrates that the neural network approach offers higher accuracy and adaptability in handling complex, nonlinear relationships inherent in environmental data. The findings suggest that BP neural networks can serve as effective tools for soil quality assessment, providing valuable insights for environmental monitoring and sustainable land management practices. Zhao Y et al[9]. The authors introduce an objective assessment method that analyzes specific video impairments such as blurring, block distortion, jerky motion, and noise in both luminance and chrominance channels. By employing a combination of objective metrics and subjective evaluations, the study aims to establish a reliable framework for assessing the perceptual quality of CMMB video sequences. The proposed method demonstrates improved correlation with human visual perception compared to traditional metrics like PSNR, offering a more accurate and efficient tool for video quality assessment in mobile broadcasting environments. Zhu S J et al[10]. The system comprises LoRaWAN-enabled end devices equipped with sensors to measure various air parameters, including temperature, humidity, and pollutant concentrations. Data collected by these sensors are transmitted to a cloud-based platform, facilitating real-time monitoring and analysis. Lishev S N et al[11]. The application of Doppler radar technology in monitoring the effects of environmental noise on cardiovascular and respiratory functions represents a significant advancement in non-invasive health assessment methods. By facilitating continuous, real-time monitoring, this approach can enhance our understanding of the physiological impacts of environmental stressors and inform strategies to mitigate associated health risks. Sameera et al [12]. The integration of standardized methodologies and bias mitigation techniques is crucial for the effective use of crowdsourcing in speech quality assessments. The work by Jiménez et al. contributes to this field by exploring strategies to remove biases inherent in noisy crowdsourcing environments, thereby enhancing the reliability and validity of collected data. Continued research and refinement of these approaches will further solidify crowdsourcing as a viable tool for large-scale speech quality evaluation. R. Z. Jiménez et al [13]. The analysis of SNR across seasons using multitemporal Resourcesat-2A LISS-3 imagery provides valuable insights into the sensor's performance under varying environmental conditions. By understanding these variations, researchers and practitioners can optimize data acquisition and processing workflows, leading to more accurate and reliable remote sensing applications in agriculture, forestry, urban planning, and environmental monitoring. Misra I et al[14]. The development of a no-reference multi-level video quality assessment metric for 3D-synthesized videos addresses a critical need in the evaluation of 3D content. By overcoming the limitations of existing metrics and eliminating the dependency on reference videos, this approach offers a robust solution for assessing the perceptual quality of 3D-synthesized videos, facilitating advancements in 3D video technologies and applications. Guangcheng Wang et al [15]. The study by Kaur and Ragha highlights the importance of addressing audio quality issues in lecture videos through advanced denoising techniques. By improving audio clarity, these methods can enhance the learning experience for students engaging with online educational materials[16]. The research presented by Battista et al. represents a significant step forward in the field of IEQ assessment. By leveraging IoT technologies, the study offers a scalable and non-intrusive method for continuous monitoring of indoor environments. This approach provides valuable data that can inform building renovation strategies, enhance occupant comfort, and ensure compliance with evolving standards. As the demand for healthier and more sustainable living spaces grows, such innovative measurement techniques will play a crucial role in shaping the future of residential building design and renovation[17]. The study by Jiménez, Naderi, and Möller underscores the critical role of environmental factors in subjective speech quality assessments conducted via crowdsourcing. By identifying and addressing the impact of environmental noise, researchers can improve the reliability and validity of these assessments, thereby advancing the field of speech quality evaluation[18]. The research by P. Shu et al. contributes to the growing body of knowledge on utilizing deep learning for enhancing remote sensing image resolution. By improving image quality, their framework supports more accurate groundwater quality assessments and comprehensive environmental monitoring in urban areas. These advancements are crucial for addressing environmental challenges and promoting sustainable urban development[19]. H. Aslam's research effectively demonstrates the use of GIS as an analytical and visualization tool for detecting potential noise pollution zones in Rawalpindi city. This work contributes to urban environmental management by providing a methodological framework that can be adapted to other cities facing similar noise challenges. It underlines the importance of integrating spatial technologies into environmental monitoring and urban planning to improve urban quality of life[20]. This paper investigates environmental pollution, focusing specifically on noise pollution levels at various end-of-life vehicle (ELV) recycling centers. The authors conduct a comparative analysis of noise measurements and pollution indicators across multiple recycling facilities to understand the environmental impact of such centers. The study highlights noise as a significant environmental concern in recycling operations, contributing to urban noise pollution. The findings aim to support regulatory frameworks and operational improvements to mitigate environmental and noise impacts in ELV recycling centers [21]. This paper presents a comparative assessment of environmental pollution and noise levels at several end-of-life vehicle (ELV) recycling centers. The authors conducted systematic noise measurements alongside evaluations of other pollution indicators to analyze the environmental footprint of ELV recycling operations. Findings reveal significant variations in noise levels across different facilities, influenced by operational scale, equipment used, and site management practices. The study highlights the environmental challenges posed by ELV recycling centers, especially regarding noise pollution, which can affect workers' health and nearby communities. Recommendations emphasize the need for regulatory oversight and adoption of noise mitigation strategies to improve environmental compliance [22].

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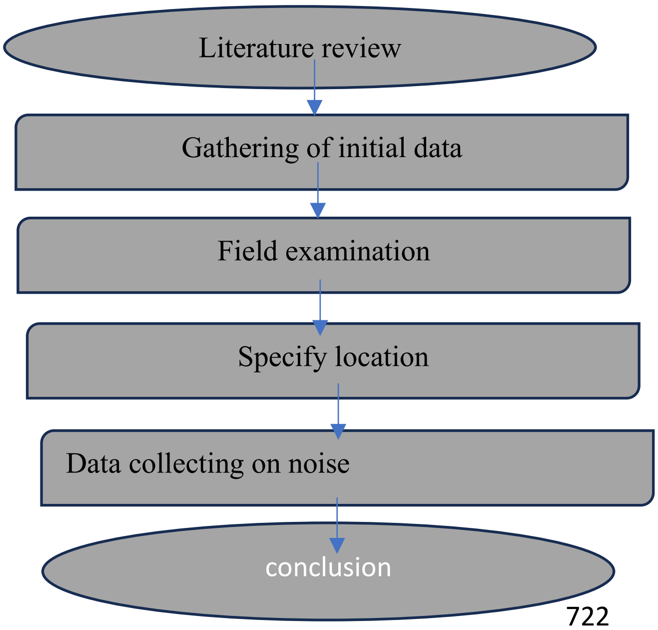
III. STUDY AREA:

Sholinganallur is a prominent residential locality in the Chennai Metropolitan Area, situated along the IT corridor in the southern part of the city, in the Indian state of Tamil Nadu. The rapid development of Sholinganallur's economy, population, and infrastructure is primarily driven by the presence of IT business parks and dedicated Special Economic Zones (SEZs).The area is surrounded by other IT-focused suburbs such as Siruseri, Perungudi, and Taramani, further reinforcing its status as a key technology hub. Sholinganallur is strategically located at a major junction that connects the East Coast Road (ECR) with Tambaram, Mudichur, and Adyar, extending southward to Mahabalipuram along the Old Mahabalipuram Road (OMR). This makes it an important transit point in the southern part of Greater Chennai.It is located approximately 14.3 km from Tambaram, 2 km from ECR, 34.8 km from Mamallapuram (Mahabalipuram), and 13.5 km from Adyar. The locality enjoys excellent road connectivity, supported by the Metropolitan Transport Corporation (MTC), TNSTC-Villupuram services, and numerous shared autorickshaws. Many IT companies are situated within a 5 km radius, making it a preferred residential area for professionals.The Sholinganallur junction is located at 102, Old Mahabalipuram Road, Nedunchezian Salai, Sholinganallur, Chennai, Tamil Nadu 600119. The geographic coordinates are 12.9010° N latitude and 80.2279° E longitude.

SHOLINGANALLUR JUNCTION

IV. METHODOLOGY:

It uses 11 hours of continuous recording, spaced one hour apart, from 8 a.m. to 6 p.m., and from a single day on Friday, to determine the noise level at Sholinganallur.



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SOUND LEVEL METER Model: SL-4010

Fig.4.2 Noise Level Meter

Ameasurement system consists of the following components:

a. the transducer, or microphone;
b. the electrical amplifier and calibrated attenuator for gain control;
c.the frequency weighting or analysisoptions
d. the data storage facilities;
e. the display

Microphones:- The microphone is the interface between the acoustic field and the measuring system. It responds to sound pressure and transforms it into an electric signal which can be interpreted by the measuring instrument (e.g. the sound level meter).

Amplifier:- An amplifier, electronicamplifier or(informally) amp is an electronic device that can increase the power of a signal (a time-varying voltage or current). An amplifier functions by taking power from a power supply and controlling the output to match the input signal shape but with a larger amplitude.

SAMPLE LOCATION

Noise level readings were recorded across three different zones:

1. Commercial Zone
2. Silent Zone
3. Residential Zone

1. Commercial Zone – Sholinganallur Junction

Sholinganallur is a major traffic junction located in the southern part of Greater Chennai. It connects the East Coast Road (ECR) to Tambaram, Mudichur, and Adyar, and also leads towards Mahabalipuram via the Old Mahabalipuram Road (OMR). Key distances include:

- 14.3 km from Tambaram
- 2 km from ECR
- 13.5 km from Adyar
- 34.8 km from Mamallapuram

This junction is well connected through roadways including MTC and TNSTC-Villupuram services, as well as shared autorickshaws. The presence of several IT companies within a 5 km radius contributes to heavy traffic flow.

Noise Measurement Setup:

- Five locations were selected around the junction.
- The first location is at the traffic signal (center of the junction).
- The remaining four locations are 50 meters away from the central point, each on a different connecting road.
- Readings were taken at one-hour intervals from 8:00 AM to 6:00 PM at all five locations.

2. Silent Zone – Mohamed Sathak College of Arts & Science

Mohamed Sathak College of Arts & Science, established in 1991, is situated at No. 13, Medavakkam Road, Sholinganallur, Chennai. The college lies approximately 550 meters from the Sholinganallur Junction.

Noise Measurement Setup:

- Five locations were selected within the college campus.
- The first location is near the main road.
- The remaining four locations are spaced 80 meters apart, progressing inward from the main road.
- Readings were recorded at one-hour intervals from 8:00 AM to 6:00 PM.
- The average number of vehicles passing the first (main road) location was 28 per 30 seconds, counted while noise measurements were taken.

3.Residential Zone – Adroit Artistica

Adroit Artistica is a residential complex located approximately 1.5 km from Sholinganallur Junction, along the route toward Mahabalipuram.

Noise Measurement Setup:

- Measurements were taken at three blocks within the complex: Block P, Block Q, and Block R.
- At each block, readings were recorded at one-hour intervals from 8:00 AM to 6:00 PM.

V. RESULTS AND DISCUSSION: -

NOISE LEVEL AT SHOLINGANALLUR JUNCTION: -

Noise level at East Coast Road route:-

TIME	MAX NOISE LEVEL	MIN NOISE LEVEL	MEAN LOISE LEVEL	AVERAGE	NO. OF VEHICLE AT AN INTERVAL OF 30 SEC
8:00 AM	78.4	63.9	71.2		25
9:00 AM	85.3	65.9	75.6		15
10:00 AM	89.8	70.1	80		32
11:00 AM	69.7	59.9	64.8	71.7	23
12:00 PM	77	70.3	73.7		17
1:00 PM	72.6	62.6	67.6		13
2:00 PM	73.8	60.5	67.2		26
3:00 PM	86.1	61.5	73.8		21
4:00 PM	83.5	59.4	71.5		30

Table 5.1 Noise Level Measurement on East Coast Road (ECR) – 50 m from Sholinganallur Signal

Noise level measurements were conducted along the East Coast Road (ECR) at a distance of 50 meters from the Sholinganallur signal junction. The data collection was performed at one-hour intervals, beginning at 08:00 hours and continuing until 18:00 hours. The recorded noise levels consistently exceeded the permissible limits as prescribed by relevant environmental noise regulations, indicating a significant level of noise pollution in this commercial traffic corridor.

Noise Level at the Main Road – Mohamed Sathak College of Arts & Science

TIME	MAX NOISE LEV	MIN NOISE LEV	MEAN LOISE LE	AVERAGI	NO. OF VEHICLE AT AN INTERVAL OI
8:00 AM	70.9	62.5	66.7		33
9:00 AM	74.5	64.9	69.7		26
10:00 AM	74	59.1	66.6		45
11:00 AM	78.4	63.3	70.9		32
12:00 PM	85.2	63.3	74.3	69.2	27
1:00 PM	77.5	60.6	69.1		21
2:00 PM	69.8	63.9	66.9		23
3:00 PM	74.2	61.8	68		21
4:00 PM	77.8	63	70.5		27

Table 5.2 presents the noise level measurements recorded at the main road adjacent to Mohamed Sathak College of Arts & Science.

Measurements were taken at hourly intervals from 08:00 hours to 18:00 hours. The data collection aimed to assess the impact of road traffic on the ambient noise levels within the silent zone classification. The observed values suggest deviations from the prescribed standards, warranting further analysis of vehicular influence on noise pollution levels.

NOISE LEVEL AT RESIDENTIAL ZONE:-

I. Noise level at P- Block

TIME	MAX NOISE LEVEL	MIN NOISE LEVEL	MEAN LOISE LEVEL	AVERAGE	NO. OF VEHICLE AT AN INTERVAL OF 30 SEC
8:00 AM	62.7	46.9	54.8		3
9:00 AM	70.8	50.6	60.7		5
10:00 AM	74.6	55	64.8		1
11:00 AM	79.5	54.3	56.9		2
12:00 PM	65.8	50.9	58.4	60.3	0
1:00 PM	76.7	55.6	66.2		1
2:00 PM	80.3	47.4	63.9		2
3:00 PM	65.7	50.5	58.1		3
4:00 PM	69	49.1	59.1		4

Table 5.3 Noise Level at P–Block – Adroit Artistica (Residential Zone)

Noise level measurements were carried out at P–Block of the Adroit Artistica residential complex. Readings were recorded at one-hour intervals starting from 08:00 hours and continuing until 18:00 hours. The measured noise levels were observed to exceed the permissible limits for residential areas, indicating a potential concern for environmental noise pollution and its impact on the quality of life within the residential zone.

V. CONCLUSION

Based on the recorded data, it is evident that the commercial zone—specifically at Sholinganallur Junction—exhibited the highest noise pollution levels when compared to both the silent zone (Mohamed Sathak College of Arts & Science) and the residential zone (Adroit Artistica). The elevated noise levels in the commercial zone can be attributed to the intense vehicular traffic, as Sholinganallur Junction serves as a critical intersection connecting multiple major routes within Chennai. The continuous flow of traffic, including private vehicles, public transport, and commercial vehicles, contributes significantly to the observed noise intensity. These findings underscore the need for effective noise mitigation strategies and urban traffic planning in high-density junctions to minimize public health risks associated with prolonged noise exposure.

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