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Assessment of the Impact of Urban Traffic on Noise Pollution in Ifite-Awka, Anambra State.

Alom Anselem Chukwuma, Egbuna Onyinyechi Kaosisochi, Orji Chukwuemeka, Abaekih Charles Emeka, Unachukwu Sophia Somkene

Department of Urban and Regional Planning, Nnamdi Azikiwe University Awka,

Abstract

This study assesses the impact of urban traffic on noise pollution in Ifite-Awka, a densely populated and rapidly urbanizing area in Anambra State, Nigeria. The objectives of the research include identifying factors contributing to noise pollution, assessing traffic origins and destinations, evaluating the health and environmental implications of traffic-induced noise, and providing actionable insights for urban planning and policy intervention. The study adopted a descriptive survey design and utilized both primary and secondary data. A sample of 398 adult residents was selected using a combination of simple random and accidental sampling techniques. Data collection was carried out using a structured questionnaire, and analysis involved descriptive statistics and chi-square tests. Findings revealed that traffic volume, road types, and land use patterns significantly contribute to noise pollution in Ifite-Awka. Traffic origins were identified as bus stops, parks, markets, and major streets, while destinations included workplaces, schools, residential areas, and commercial zones. Health implications identified included sleep disturbances, stress, and anxiety, while environmental impacts included disruption of natural habitats. Hypothesis testing confirmed significant relationships between population density and stress, as well as between traffic origin points and sleep disturbances. The study recommends strategies such as the construction of sound barriers, promotion of green infrastructure, enforcement of vehicle noise standards, and the integration of noise mitigation into urban planning.

Keywords: Urban Traffic, Noise Pollution, Ifite-Awka, Environmental Impact, Public Health, Traffic Volume, Land Use, Urban Planning, Nigeria

1.0 Background of the Study

Urbanization is an inevitable consequence of human development, often accompanied by environmental challenges, among which noise pollution is prominent. As cities grow, they attract increasing numbers of people, resulting in the expansion of residential, commercial, and transport activities. This growth leads to higher traffic generation and a subsequent rise in vehicular movement. Without adequate control, such developments contribute significantly to environmental noise, particularly in developing urban centers like Ifite-Awka in Anambra State.

The continuous influx of people into Ifite-Awka, driven by urban expansion and the area's strategic importance within Awka, has intensified human interactions with the built environment. This interaction has led to increased traffic volumes, especially during peak hours, contributing to elevated noise levels. Urban traffic comprising cars, buses, motorcycles, and heavy-duty vehicles has become a major source of ambient noise

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pollution. This scenario, if unchecked, could pose serious threats to the quality of life and public health.

Noise pollution is more than just a nuisance; it is a significant public health concern. According to Basner et al. (2014), chronic exposure to high noise levels can lead to stress, sleep disturbances, reduced cognitive performance, and long-term cardiovascular problems. These impacts are particularly severe in densely populated areas where traffic noise is persistent and pervasive.

Awka, the capital of Anambra State, has experienced rapid urbanization in recent years, marked by infrastructural development and increased vehicular density (Okafor, 2018). The transformation of the city's transport network has altered its acoustic environment, especially in rapidly developing areas like Ifite-Awka. The expanding road network and increased vehicular mobility have undoubtedly improved connectivity, but they have also introduced a new set of environmental concerns, with noise pollution becoming increasingly prominent.

Several studies have demonstrated a direct correlation between traffic volume and noise pollution levels. For instance, Wang et al. (2017) in their study in Beijing, China, found that traffic flow and road types significantly predicted urban noise levels. Similarly, Otitoloju and Oluleye (2019) identified a strong relationship between traffic density and elevated noise levels in Lagos, Nigeria, which negatively affected residents' quality of life. Given these findings and the observed urban and traffic dynamics in Ifite-Awka, it becomes essential to investigate the extent to which urban traffic contributes to noise pollution in the area. Understanding this relationship is crucial for designing evidence-based urban planning policies and environmental noise control strategies.

This study, therefore, seeks to assess the impact of urban traffic on noise pollution in Ifite-Awka by measuring noise levels across selected traffic-prone locations. The research aims to provide data-driven insights that can inform noise abatement policies and enhance the livability of urban environments within Awka and beyond. The rapid urbanization of Awka, particularly in the Ifite area, has brought about a significant increase in vehicular movement and human activities. While this urban growth has enhanced economic opportunities and improved accessibility, it has also introduced environmental challenges—chief among them being noise pollution.

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Despite the growing awareness of the negative impacts of noise on public health and urban quality of life, the issue of traffic-induced noise pollution remains largely overlooked in urban planning and policy implementation within the area.

In Ifite-Awka, traffic congestion is a daily occurrence, especially during peak hours, due to the high influx of students, residents, commercial activities, and inadequate road infrastructure. This congestion leads to increased engine idling, frequent honking, and continuous vehicular movement, all of which contribute to excessive noise levels in the environment. Yet, there is a noticeable absence of empirical data or structured assessments of the actual noise levels generated by urban traffic in this locality.

Furthermore, while global studies have established strong links between traffic density and noise pollution, there is limited localized research in Awka that quantifies this relationship or explores its implications for public health and urban development. Without such data, policymakers and urban planners lack the evidence needed to design effective interventions or regulatory frameworks to mitigate the problem.

Therefore, the core problem this study addresses is the lack of empirical understanding of how urban traffic contributes to noise pollution in Ifite-Awka, and how this affects the environmental quality and well-being of its residents. The research aims to fill this critical knowledge gap by assessing noise pollution levels in traffic-prone areas and examining the correlation between traffic volume and noise intensity.

2.0 Conceptual Framework

Concept of Urban Traffic

Urban traffic refers to the movement of vehicles and pedestrians within urban environments, characterized by varying traffic conditions, congestion, and complex mobility patterns. In layman's terms, it entails the daily flow of people and vehicles through the city, especially during peak periods, often accompanied by traffic jams and delays.

According to Ifebuna (2017), urban traffic is the flow of vehicles and people along streets and roads within urban areas, governed by the design and limitations of city infrastructure. Similarly, Ikenna (2018) defines it as the increased density of vehicles typically experienced in the central business districts of urban areas, often resulting in slow movement, gridlock, and reduced efficiency in transportation systems. Fabian

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(2018) expands this definition by emphasizing the temporal patterns of urban traffic, particularly movement to and from city centers during rush hours, which affects both travel time and road usage patterns.

Chambers (2017) highlights that urban traffic encompasses not only motor vehicles but also pedestrian movement and the challenges of overcrowded public transport systems, such as buses and subways. Balogun (2018) adds a spatial dimension by describing urban traffic as shaped by the visual and physical structure of cities including roads, bridges, and tunnels which determine how people and vehicles move. Allan (2016) interprets urban traffic as the collective obstacles, delays, and navigation issues faced by commuters, influenced by travel modes and traffic conditions. For the purpose of this study, urban traffic is defined as the movement of motor vehicles and transport systems that convey people and goods from one location to another, especially by road. This includes cars, trucks, buses, tricycles, motorcycles, and other mobile transport vehicles whose volume and flow contribute significantly to the overall transportation dynamics and environmental conditions within urban areas like Ifite-Awka.

Concept of Noise Pollution

Noise pollution refers to any unwanted, excessive, or disruptive sound that negatively impacts the health, comfort, or quality of the environment. Kumar and Jain (2019) define noise pollution as sound that interferes with normal environmental quality, often causing discomfort or distress. Ilomuaya (2020) describes it as sound exceeding acceptable thresholds measured in decibels (dB) which becomes detrimental to human and environmental well-being.

Noise pollution is a major urban concern because of its adverse effects on physical and mental health, including stress, hearing loss, sleep disorders, cardiovascular problems, and reduced cognitive performance (World Health Organization, 2019). It is generated by various human activities and urban infrastructure.

Common sources include:

- Vehicular traffic (cars, buses, motorcycles): the leading source of urban noise.
- Industrial operations: machinery, factories, and power plants.
- Construction activities: heavy equipment, drilling, and building operations.

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- Social and recreational events: concerts, markets, sporting activities, and public gatherings (Pollen, 2018).
- Aircraft noise: particularly near airports, due to takeoffs and landings.
- Residential noise: appliances, generators, loud music, and public address systems (James, 2017).
- Commercial areas: shops, restaurants, and entertainment centers also contribute significantly.

According to Ike (2016), in cities like Awka, traffic noise is a persistent issue that affects daily life. Ghattas (2019) warns that noise pollution is an invisible hazard unseen, yet pervasive, affecting not only human life but also wildlife and ecosystems.

In the context of this study, noise pollution is defined as any unwanted or excessive sound primarily generated by urban traffic, which negatively affects the health, comfort, productivity, and environmental quality of residents in Ifite-Awka. It includes consistent exposure to traffic noise from cars, motorcycles, and commercial vehicles in congested areas and traffic-prone routes.

Theoretical Framework

A theoretical framework provides the foundation upon which a study is built, guiding the research questions, methodology, and interpretation of findings. For this study on the impact of urban traffic on noise pollution in Ifite-Awka, the following theories are relevant:

Environmental Stress Theory

The Environmental Stress Theory, proposed by Lazarus and Cohen (1977), posits that certain environmental factors, such as noise, temperature, and crowding, act as stressors that negatively affect human well-being. According to the theory, persistent exposure to stress-inducing environments can lead to physiological and psychological strain.

In the context of this study, traffic-generated noise acts as a chronic environmental stressor. The theory suggests that individuals living or working in areas of high noise exposure such as along busy roads are likely to experience elevated stress levels, reduced concentration, sleep disruption, and other health complications. This framework is crucial for understanding the human response to increasing urban traffic and the adverse health outcomes associated with prolonged noise exposure.

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Urban Ecology Theory

The Urban Ecology Theory, rooted in the work of the Chicago School of Sociology, explains the relationship between human behavior and the urban environment. It examines how urban development patterns, population density, and infrastructure affect the quality of urban life.

Applied to this study, the theory helps to explain how increased urbanization and traffic flow in Ifite-Awka reshape the acoustic environment of the area. Urban development when unplanned leads to congestion, increased vehicle density, and higher noise levels. This theory supports the study's exploration of how land use, population growth, and road network expansion correlate with rising noise pollution levels in urban areas.

Systems Theory

The Systems Theory views cities as complex, interrelated systems where transportation, land use, infrastructure, environment, and human behavior interact dynamically. When one part of the system—such as road traffic—increases without corresponding improvements in infrastructure or regulation, it creates ripple effects on other parts, including environmental quality.

This theory is relevant to the study because it recognizes that urban traffic is not an isolated issue but one linked to multiple urban systems. The rise in traffic volume due to poor urban planning, lack of public transportation alternatives, and population growth leads to noise pollution, which in turn affects public health and urban sustainability. The theory helps frame noise pollution as an outcome of interdependent urban factors, not just vehicle presence.

Relevance to the Study

These theories collectively support the central aim of the study: to assess how urban traffic contributes to noise pollution in Ifite-Awka. They offer theoretical insight into the cause-effect relationship between increased vehicular activity and the environmental and health impacts experienced by residents. They also underscore the need for systematic urban planning, environmental regulation, and public health interventions.

3.0 Literature Review

Urbanization in Awka and Traffic Growth in Ifite-Awka

Urbanization in Awka, the capital of Anambra State, Nigeria, has been characterized by rapid population growth, expansion of residential and commercial areas, and an increased demand for infrastructure and services. According to the

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Awka Urban Development Authority (2020), the city's population has consistently increased over the past few decades due to natural population growth, rural-to-urban migration, and socio-economic development. This trend aligns with the broader urbanization pattern in Nigeria, where cities are experiencing demographic and spatial growth due to internal migration and developmental pressures. Ifite-Awka, a strategic urban suburb within Awka South Local Government Area, has not been exempt from this transformation. The area has witnessed significant growth in built-up spaces, institutional establishments (including Nnamdi Azikiwe University), and commercial activities.

These developments have, in turn, led to an increased demand for mobility and a sharp rise in vehicular traffic. As more people move into Ifite-Awka for residential, educational, and economic reasons, traffic volumes have surged. The road network has expanded in response, but not always in a coordinated or sustainable manner. This has led to recurring traffic congestion, especially during peak hours. Haghighat et al. (2017) noted that traffic congestion is a common feature in urban areas experiencing rapid population growth and unplanned spatial expansion. In the case of Ifite-Awka, this has become increasingly visible along major roads, access points to the university, and busy intersections. Urbanization, broadly defined, is the process of population migration from rural to urban areas, resulting in the expansion and densification of urban settlements. It is a global phenomenon accelerated by economic, industrial, and infrastructural factors. While urbanization brings opportunities, it also presents complex challenges particularly in the area of transportation. One of the most immediate effects of urban growth is the increased demand for transportation and the accompanying challenges of traffic management.

Key Drivers of Urbanization in Ifite-Awka

Several interrelated factors are responsible for the ongoing urbanization and corresponding traffic growth in Ifite-Awka:

1. **Economic Opportunities:** Urban areas typically offer better job prospects, higher income potential, and improved access to markets, education, and healthcare. Awka serves as the commercial and administrative hub of Anambra State. As such, people from surrounding suburbs and rural communities frequently travel to Ifite-Awka to buy and sell goods, engage in business, or access services. This economic migration constantly fuels vehicular movement and congestion in the area.

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2. **Industrialization**: Although Awka is not a heavily industrialized city, the growth of service-based industries, institutional development, and government establishments has increased the demand for labor and services in Ifite-Awka. The resulting influx of people from other towns contributes to urban crowding and increased traffic volume.
3. **Modernization and Infrastructural Development**: As a state capital, Awka has witnessed relatively faster modernization compared to other towns in the state. Improved infrastructure, better security, and social amenities attract individuals seeking a higher quality of life. Ifite-Awka, in particular, is perceived as a developing urban enclave offering modern conveniences and proximity to government institutions and higher education facilities, making it a preferred destination for migration.
4. **Population Growth**: Both natural population growth and rural-to-urban migration contribute to urban sprawl. The presence of institutions such as **Nnamdi Azikiwe University** and other tertiary institutions in Ifite-Awka has attracted students, academic staff, and support services, thereby accelerating population growth. This demographic pressure places additional demand on the existing road network, thereby increasing traffic density.

Effects of Urbanization on Traffic Growth

Urbanization exerts multiple pressures on urban transportation systems. Some of the key effects observed in Ifite-Awka include:

1. **Increased Vehicle Ownership**: As urban income levels rise and public transportation remains inadequate, many residents resort to personal vehicle ownership, contributing to road congestion.
2. **Infrastructure Strain**: The road infrastructure in Ifite-Awka has not kept pace with the population and vehicular growth. Inadequate road capacity, lack of pedestrian walkways, and poor maintenance exacerbate traffic challenges.
3. **Air Pollution**: High traffic density leads to increased vehicular emissions, which contribute to environmental pollution and pose public health risks, especially in densely populated areas.
4. **Economic Costs**: Traffic congestion leads to longer travel times, increased fuel consumption, and productivity losses. It also affects the timely delivery of goods and services.

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5. **Public Health Concerns**: Besides contributing to air pollution, heavy traffic generates noise pollution, which has been linked to stress, hearing loss, sleep disturbances, and other health issues (Oduyemi et al., 2014)

Health Impact of Noise Pollution

Noise pollution in Nigeria, particularly in rapidly urbanizing environments like Ifite-Awka, poses significant public health risks. Numerous global and local studies have consistently shown that prolonged exposure to high noise levels, especially from urban traffic, can have detrimental effects on physical, mental, and social well-being. Inhabitants of urban centers, where traffic congestion and unregulated noise sources are common, are particularly vulnerable.

Key Health Impacts Associated with Noise Pollution in the City

1. **Stress and Anxiety**: Continuous exposure to traffic noise in densely populated urban areas such as Ifite-Awka can result in chronic stress and heightened anxiety levels. The persistent auditory disturbance interferes with daily routines and relaxation, leading to negative psychological effects (WHO, 2018).
2. **Sleep Disturbance**: Nighttime noise from traffic and other urban activities often disrupts sleep cycles. Residents in Ifite-Awka may find it difficult to fall asleep, maintain deep sleep, or feel rested upon waking, which can affect productivity and overall health (Babisch, 2011; Environmental Health Perspectives, 2012).
3. **Cardiovascular Problems**: Prolonged exposure to elevated noise levels has been linked to cardiovascular conditions such as hypertension and heart disease. Traffic-related noise contributes significantly to these risks, especially in urban settings (WHO, 2018; Environmental Research, 2019).
4. **Cognitive Impairment**: Noise pollution has been shown to impair cognitive functioning in both children and the elderly. In areas like Ifite-Awka, frequent exposure to traffic noise may reduce concentration and learning capabilities, affecting academic and occupational performance (Basner et al., 2014).
5. **Hearing Impairment**: Long-term exposure to high-intensity noise can result in hearing damage, particularly in occupational settings or areas with frequent loud traffic. This is due to damage to the sensory hair cells in the inner ear (NIDCD, 2020).
6. **Mental Health Issues**: The mental toll of noise pollution includes increased risks of depression, irritability, and overall

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psychological distress. Studies link traffic noise to reduced mental well-being and increased rates of psychiatric disorders (The Lancet, 2013).

7. **Increased Risk of Hypertension and Myocardial Infarction**: Research indicates a strong correlation between chronic exposure to road traffic noise and the development of hypertension and heart attacks (Environmental Health Perspectives, 2017).
8. **Reduced Quality of Life**: Persistent noise pollution can diminish overall quality of life by affecting leisure, communication, rest, and general satisfaction with the living environment (EEA, 2010).
9. **Social and Behavioral Effects**: Noise can affect interpersonal relationships and community cohesion. It may increase aggression, reduce social tolerance, and lead to behavioral changes (WHO, 2009).

These health effects emphasize the urgent need for targeted research and actionable policies to address noise pollution in Ifite-Awka. Protecting the well-being of residents requires comprehensive and sustainable interventions.

Mitigation Strategies and Policy Framework

Effectively addressing urban noise pollution in Awka, and particularly in Ifite-Awka, requires a multidimensional approach combining engineering solutions, urban planning, public awareness, and regulatory enforcement.

Key Mitigation Strategies

1. **Noise Barriers**: Erecting physical barriers along busy roads helps block and absorb traffic noise before it reaches residential areas. These barriers can significantly reduce noise levels when properly designed and maintained (EIA, 2020).
2. **Quiet Road Surfaces**: Using specially designed low-noise asphalt materials can reduce tire-road interaction noise. This measure, when implemented in road projects in Ifite-Awka, could significantly lower traffic-related sound emissions (Cirillo et al., 2017).
3. **Green Infrastructure**: The integration of trees, shrubs, and green belts along road corridors serves as a natural buffer, absorbing noise and improving air quality. Green spaces also enhance aesthetic and recreational value (EIA, 2020).
4. **Improved Traffic Management**: Efficient traffic flow reduces congestion and frequent acceleration and deceleration, which are major contributors to traffic noise. Urban transport planning should include traffic calming measures, signal optimization, and road network improvements.

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Policy Framework and Institutional Support

1. **Federal Environmental Protection Agency (FEPA) Regulations**: The FEPA Act outlines standards for permissible noise levels in Nigeria and mandates local authorities to monitor and control noise pollution. In Ifite-Awka, local implementation of these national regulations is crucial (FEPA, 2009).
2. **Enforcement and Compliance Mechanisms**: Regulations alone are insufficient without active monitoring and enforcement. Government agencies must deploy personnel and equipment to assess noise levels and penalize non-compliance (Olawoyin et al., 2015).
3. **Public Awareness and Education**: Community engagement and education on the health risks of noise pollution are essential. Awareness campaigns can foster responsible behavior, including reduced honking, proper vehicle maintenance, and support for noise control initiatives.

A coordinated effort involving policymakers, urban planners, public health officials, and residents is vital to mitigating noise pollution and promoting a healthier, more livable environment in Ifite-Awka

Traffic and Noise Pollution

Traffic pollution primarily arises from the combustion of fossil fuels in motor vehicles such as cars, trucks, and buses. This process emits a variety of pollutants, including carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (PM).

Effects of Traffic Pollution

1. **Air Quality:** Traffic emissions degrade air quality by contributing to ground-level ozone and particulate matter, which aggravate respiratory conditions like asthma and elevate cardiovascular disease risks (HEI, 2010).
2. **Health Impact:** Prolonged exposure to vehicular pollution is associated with increased cases of bronchitis, lung cancer, and heart disease (Dockery et al., 1993; HEI, 2010).
3. **Noise Pollution:** The operation of vehicles contributes significantly to urban noise levels, which can interfere with sleep, impair cognition, and lead to hypertension and stress-related conditions (Basner et al., 2014; WHO, 2011).

Effects of Noise Pollution

Noise pollution, largely driven by urban traffic, poses a major public health risk.

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1. **Sleep Disturbance:** Chronic exposure to high noise levels disrupts sleep patterns, causing sleep deprivation and reduced daytime functioning (Stansfeld & Matheson, 2003; Muzet, 2007).
2. **Mental Health:** Persistent noise increases stress, anxiety, and depression, leading to reduced psychological well-being (Stansfeld et al., 2000; Clark & Paunovic, 2016).
3. **Cardiovascular Risk:** Numerous studies have linked noise exposure to hypertension and heart disease (Babisch, 2006; Münzel et al., 2017).

Mitigation Strategies for Traffic and Noise Pollution

1. **Public Transportation:** Expanding reliable mass transit systems can reduce the number of vehicles on the road, lowering both emissions and noise (Litman, 2019).
2. **Electric and Hybrid Vehicles:** Adoption of low-emission vehicles can significantly reduce pollutants and operational noise (Schoettle & Sivak, 2015).
3. **Urban Design:** Incorporating green spaces, walkable infrastructure, and bicycle paths can reduce traffic congestion and emissions (Handy et al., 2002).
4. **Noise Barriers:** Physical barriers along roadways are effective in limiting noise intrusion into residential areas (Gidlöf-Gunnarsson & Öhrström, 2010).
5. **Regulatory Measures:** Enforcing noise control policies and zoning laws helps reduce the impact of noise in sensitive zones, especially during nighttime (EPA, 2021).

Traffic Volume

Traffic volume refers to the number of vehicles traveling on a road or highway during a specific time interval. It is a core metric in transport planning and system efficiency evaluation.

Factors Influencing Traffic Volume

1. **Population Density:** Urban areas with dense populations naturally experience higher traffic levels (Ferguson et al., 2014).
2. **Economic Activities:** Industrial and commercial hubs attract significant vehicular movement (Levinson & Kumar, 1994).
3. **Land Use Patterns:** Proximity to schools, markets, and job centers influences traffic volume (Cervero, 2001).

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4. **Infrastructure Quality:** The condition and design of road networks play a crucial role in accommodating traffic volume (Puentes & Tomer, 2010).
5. **Traffic Policies:** Congestion pricing, tolls, and HOV lanes can influence vehicle flow (Small & Verhoef, 2007).

Significance and Applications of Traffic Volume Data

1. **Congestion Analysis:** Data aids in identifying congestion hotspots and managing peak-hour traffic (FHWA, 2012).
2. **Infrastructure Development:** Supports decision-making on road expansions or new infrastructure (Levinson, 1998).
3. **Environmental Assessments:** High volumes correlate with air and noise pollution levels (US EPA, 2009).
4. **Road Safety:** Traffic volume helps identify accident-prone zones (Hauer, 1997).

Trip Origin and Destination

The concept of **Trip Origin and Destination (OD)** involves identifying where a journey starts and where it ends. This data is essential in understanding travel behavior and optimizing transportation systems.

Importance of Trip OD Analysis

1. **Urban Transport Planning:** OD data guides the design of transport networks and infrastructure based on actual demand (Miller, 2010).
2. **Traffic Flow Optimization:** Engineers use OD data to improve signal timing and lane design (Bates et al., 2001).
3. **Transit Services:** Public transport schedules and routes are fine-tuned using OD patterns (Strathman et al., 2011).
4. **Environmental Monitoring:** OD patterns help assess travel-based emissions and energy consumption (De Witte et al., 2016).
5. **Land Use Strategy:** Helps planners balance residential, commercial, and industrial land use (Cervero & Murakami, 2010).

Data Sources for OD Analysis

1. **Surveys:** Traditional surveys (in-person, digital) gather detailed trip purpose, mode, and timing (Axhausen et al., 2002).
2. **Smart Mobility Tools:** GPS-enabled devices and ride-share platforms provide real-time OD data (Zhang et al., 2020).

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3. **Census Data:** Offers a macro-level view of home-to-work trip patterns (U.S. Census Bureau, n.d.).
4. **Traffic Counters:** Automated systems provide flow data used to infer OD patterns (Zhao et al., 2018).

4.0 Study Area and Research Methodology

Ifite-Awka is situated in Awka South Local Government Area of Anambra State, Southeastern Nigeria. The geographical coordinates are approximately 6°15'0" North latitude and 7°5'0" East longitude. It is bordered by neighboring towns such as Okpuno, Okpuno-Awka, Agulu, and Mgbakwu.. Administratively, Ifite-Awka is divided into three villages: Enu-Ifite, Agbana-Ifite, and Ezinato-Ifite. Ifite-Awka lies below 300 metres above sea level, nestled in a valley on the expansive plains of the Mamu River. Its topography is largely defined by two ridges running in a north-south direction. These ridges reach their highest elevation near Agulu, just outside the Anambra State Capital Territory.

Approximately six kilometers east of Agulu, the minor cuesta peaks at about 150 metres above sea level, marking the highest point in Ifite-Awka. The area is characterized by fertile tropical valleys, although much of the original rainforest vegetation has been cleared due to agricultural activities and urban settlement. Pockets of primary forest remain, particularly around cultural and sacred sites such as the Ime Oka shrine. The surrounding landscape is dominated by wooded savannah grasslands, especially to the north and east.

Ifite-Awka is located in the tropical rainforest zone of Nigeria and experiences a tropical climate with two distinct seasons driven by prevailing wind patterns. The Southwest monsoon winds from the Atlantic Ocean bring heavy rainfall between April and October, accounting for the area's wet season. In contrast, the Northeast trade winds from the Sahara Desert result in a dry season from November to March. A notable climatic feature is the Harmattan a dry, dusty wind that typically occurs in late December to January, creating a hazy atmosphere and reducing visibility. Temperature averages between 27°C and 30°C from June to December but rises to 32°C to 34°C during the peak dry months (January–April), with intense heat marking the end of the dry season.

Ifite-Awka is an integral part of Awka, one of the oldest settlements in Igboland. It is historically linked to the Nri civilization, a renowned center of early Igbo culture and spirituality, famous for bronze works dating back

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to around 800 AD among the earliest documented in Sub-Saharan Africa. The original inhabitants, known as the Ifiteana (meaning "people who sprouted from the earth"), were farmers, hunters, and skilled ironworkers who settled along the Ogwugwu Stream in the present-day Nkwelle ward. Their revered deity, Okika-na-ube, symbolized strength and was worshipped with ivory tusks (okike) and iron objects. Over time, the name Umu-Okanube (worshippers of Okanube) evolved into Umu-Oka, then Oka, and finally Awka. Awka became widely known for its metalworking expertise, with blacksmiths crafting tools, ceremonial staffs (such as the Oji and Ngwuagilija), and Dane guns. The town was also home to the Agbala Oracle, a revered deity associated with the Long Juju of Arochukwu, playing a major role in precolonial judicial and spiritual matters across Igboland before its destruction by colonial authorities.

Pre-colonial governance in Ifite-Awka, as in greater Awka, was maintained by a council of titled men known as Ozo and Ndichie. Community affairs were deliberated during Izu Awka meetings, usually hosted by the oldest man in the community, who also served symbolically as the Nne Uzu or "master blacksmith" a title signifying honor and craftsmanship rather than literal trade practice.

Research Design

The design for this study is the descriptive survey design. According to Nworgu (2015), a descriptive survey is a research design used to gather primary data to provide accurate information concerning a given population. It involves studying a group of people or items by collecting and analyzing data from a subset that is representative of the entire group. Descriptive research seeks to systematically describe a phenomenon, situation, or population by answering the questions of "what," "when," "where," and "how," rather than "why." The design does not involve manipulating variables, but rather observing and measuring them.

Surveys and observations are the most commonly used methods in this design, utilizing both online and offline tools to gather data in alignment with the research objectives.

The study relied on primary data collected through surveys in the study area. Data were gathered on:

- Contributors to traffic noise pollution
- Traffic origins and destinations
- Health and environmental implications of traffic noise pollution

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- Insights for urban planners and policymakers

The target population comprises adult inhabitants of Ifite-Awka, located in Awka South Local Government Area of Anambra State. The estimated population is 72,300 (Anambra State Government, 2023), consisting of students, businesspersons, indigenes, and non-indigenes.

Data were sourced through Primary data and Secondary data. Primary data were collected through a field survey using a structured questionnaire. These included demographic details and responses directly addressing the research objectives. Secondary data were sourced from books, journals, published and unpublished papers, official reports, the internet, maps, and records from Anambra State Government (ANSG), National Population Commission (NPC), and National Bureau of Statistics (NBS).

The sample frame includes adult residents of Ifite-Awka, regardless of occupation, socio-economic status, or religion, as long as they have experience and knowledge relevant to the study objectives. The sample size was determined using the Taro Yamane statistical formula:

The formula is given as thus, $n = \frac{N}{1+N(e)^2}$

Where: n = sample size sought
N= Adult population
1= constant
e = Degree of error (0.05)

Therefore,

$$n = \frac{72,300}{1+ 72,300\ (0.05)^2}$$

$$n = \frac{72,300}{1+ 72,300\ (0.0025)}$$

$$n = \frac{72,300}{1+ 180.75}$$

$$n = \frac{72,300}{181.75}$$

$$n = 397.79$$

n= 398 (approximately). Thus, a sample size of 398 respondents was adopted. The study employed a multistage sampling technique. First, simple random sampling was used to select streets from the selected villages. Then, accidental sampling was used to select households, hostels, and businesses from which respondents were drawn. The instrument used was a structured questionnaire divided into five sections (A–E):

- **Section A** gathered socio-demographic data (e.g., age, gender, marital status, occupation).
- **Sections B–E** contained 5-point Likert scale questions based on the study's problem statement, objectives, research questions, and hypotheses.

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Validity and Reliability of Instrument

To ensure validity, the instrument was reviewed to align with the study objectives. A pilot study was conducted, and Cronbach's Alpha was used to test reliability. The resulting reliability coefficients for the various clusters were: 0.78, 0.84, 0.72 and 0.81. These indicate a high level of internal consistency.

The researcher personally administered the questionnaires using the face-to-face method, which allowed for clarification where needed and ensured a higher response rate and minimal loss or damage of instruments.

- **Descriptive statistics** (mean and standard deviation) were used to analyze demographic data and address the research questions.
- **Inferential statistics**, specifically the **Chi-square (χ^2) test**, was used to test the hypotheses at the 0.05 level of significance.

The Formula for Chi-square (x^2) is

$$x^2 = \Sigma \frac{(o-e)^2}{e}$$

Where:

Σ= Summation

o = Observed frequency

e = Expected frequency

In order to calculate for the degree of freedom, the formula (R-1) (C-1)

R= Number of rows

C= Number of columns

After applying the above formula, the x^2 cal will be compared with x^2 tab.

Decision rule: Reject null hypothesis if x^2 cal > x^2 tab.

5.0 Results

Table below presents the results of the chi-square (χ^2) tests conducted to evaluate the significance of relationships between traffic-related variables and health implications of noise pollution in Ifite-Awka. For the first hypothesis, the calculated chi-square value of 31.76 exceeded the tabulated value of 26.29 at a 0.05 level of significance, leading to the rejection of the null hypothesis. This indicates a statistically significant relationship between population density and stress as a health impact of traffic-related noise. Similarly, the second hypothesis showed a calculated chi-square value of 42.61, which also exceeded the tabulated value of 26.29 at the same significance level.

Consequently, the null hypothesis was rejected, confirming a significant relationship between bus-stop as a traffic origin and sleep disturbance. These findings suggest that both population

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density and traffic generators like bus-stops contribute notably to noise pollution and its associated health effects in the study area.

Chi-Square (χ^2) Test of Significance for Research Hypotheses

Hypothesis	Variables Tested	Chi-square Calculated (χ^2)	Chi-square Tabulated (Critical Value)	Level of Significance (α)	Decision	Interpretation
Hypothesis One	Population Density vs. Stress	31.76	26.29	0.05	Reject H_0	Significant relationship exists between population density and stress due to noise pollution
Hypothesis Two	Bus-stop as Traffic Origin vs. Sleep Disturbance	42.61	26.29	0.05	Reject H_0	Significant relationship exists between traffic origins (bus-stops) and sleep disturbance due to noise pollution

Notes:

- **H** = Null Hypothesis
- The chi-square test reveals that both relationships are statistically significant at the 5% level (α = 0.05), as the calculated values exceed the critical value.

Summary of Findings

The major findings of the study are summarized as follows:

1. Traffic volume, road types, and road use patterns were identified as key contributors to noise pollution in Ifite-Awka, Anambra State.
2. Traffic origins in Ifite-Awka include bus-stops, bus parks, major roads, roundabouts, markets, and streets, while traffic destinations comprise workplaces, educational institutions, residential areas, and business premises.
3. The health implications of traffic noise pollution in the study area include sleep disturbances, stress, and anxiety, while the primary environmental implication is the disruption of natural habitats and ecosystem balance.

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4. The study provided valuable insights for urban planners and policymakers, including the need to:

- Design and install sound barriers along major roads and densely trafficked areas.
- Promote green spaces and tree-lined streets.
- Optimize traffic flow and minimize congestion.
- Utilize soundproof materials in road construction.
- Reduce vehicular usage through improved public transport systems.
- Implement stricter vehicle noise regulations.
- Prioritize the development of pedestrian-friendly zones.
- Encourage the adoption of electric and low-emission vehicles.

5. A statistically significant relationship was found between population density (as a source of traffic volume) and stress (as a health implication of noise pollution) in Ifite-Awka.
6. A significant relationship also exists between bus-stops as traffic origins and sleep disturbance (as a health implication of traffic noise pollution) in the study area.

6.0 Discussion of Findings

This study assessed the impact of urban traffic on noise pollution in Ifite-Awka, Anambra State. To achieve this, four research questions and two hypotheses were explored. The discussion of findings is structured around the study's four objectives:

Factors Contributing to Noise Pollution

The study identified traffic volume, road types, and land use patterns as key contributors to noise pollution in Ifite-Awka. Specifically, under traffic volume, factors such as population density, public transportation, vehicle types, road infrastructure, and urbanization were found to significantly contribute to increased noise levels. This finding is in partial agreement with Ferguson et al. (2014), who found that areas with higher population density typically experience higher traffic volumes due to the concentration of people and vehicles in urban regions.

In terms of road types, the study revealed that traffic density, road design, and road maintenance practices influence the generation and propagation of traffic noise. Furthermore, the analysis of land use patterns showed that commercial activities, use of light vehicles, and pedestrian intensity contribute significantly to the ambient noise environment. These patterns amplify noise levels, especially in mixed-use urban areas like Ifite-Awka.

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Traffic Origins and Destinations

The study identified key traffic origins in Ifite-Awka as bus stops, bus parks, major roads, roundabouts, markets, and inner streets. Traffic destinations were found to include workplaces, educational institutions, residential areas, and business premises. This finding aligns with Miller (2010), who emphasized that public transit systems are often major origins of traffic in urban centers, contributing to both congestion and associated noise levels.

Health and Environmental Implications of Noise Pollution

The research established that the major health implications of traffic noise pollution in Ifite-Awka include sleep disturbances, stress, and anxiety. These findings support the report by the World Health Organization (2018), which documented that prolonged exposure to traffic noise, particularly in densely populated areas, increases the risk of mental stress and anxiety. Similarly, Babisch (2011) also found that noise pollution can disrupt normal sleep cycles, leading to long-term health consequences.

In terms of environmental impacts, the study found that noise pollution contributes to the disruption of natural habitats and disturbance of local ecosystems, particularly in areas with significant biodiversity and green spaces affected by uncontrolled traffic development.

Policy Insights for Urban Planners and Policymakers

The study offered several practical strategies and policy recommendations to mitigate the effects of traffic noise pollution in urban areas. These include:

- Designing and installing sound barriers along high-traffic areas.
- Promoting urban green spaces and tree-lined streets to naturally absorb sound.
- Optimizing traffic flow and reducing congestion through intelligent traffic management systems.
- Utilizing soundproof materials in road and building construction.
- Reducing vehicular usage by improving public transport and non-motorized transport options.
- Implementing stricter vehicle noise standards and promoting the use of electric vehicles.
- Prioritizing pedestrian-friendly zones and environmentally sustainable transport policies.

These recommendations provide a framework for sustainable urban noise management and support more livable environments in growing urban centers like Ifite-Awka.

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7.0 Conclusion

Based on the findings of this study, it is concluded that traffic volume, road types, and land use patterns are significant contributors to noise pollution in Ifite-Awka, Anambra State. The study also established that traffic in the area originates from specific points such as bus stops and markets, and leads to destinations including workplaces, schools, and residential areas. Additionally, the research confirmed that traffic noise pollution in the study area has both health implications such as stress, sleep disturbances, and anxiety and environmental effects, including disruption of natural habitats and ecosystem disturbance. These findings underscore the urgent need for comprehensive measures to mitigate traffic-induced noise pollution in Ifite-Awka.

Recommendations

Drawing from the findings of the study, the following recommendations are proposed:

1. **Construction of Sound Barriers**: Urban planners should incorporate the design and construction of sound barriers along major roads and high-traffic areas to reduce the level of traffic noise and its adverse environmental and health impacts.
2. **Promotion of Green Infrastructure**: The development of green spaces and tree-lined streets should be prioritized to act as natural noise buffers and to manage congestion resulting from population density.
3. **Traffic Flow Optimization**: Urban traffic systems should be improved to optimize traffic flow and minimize congestion, particularly around traffic origins such as bus stops and commercial centers, in order to reduce associated noise levels.
4. **Use of Soundproof Materials in Construction**: Road and infrastructure construction in the area should incorporate sound-absorbing or soundproof materials to minimize the transmission of vehicular noise.
5. **Enforcement of Vehicle Noise Standards**: Policymakers should implement and enforce stricter regulations on acceptable vehicle noise levels, including mandatory inspections and penalties for non-compliant vehicles.
6. **Prioritization of Pedestrian-Friendly and Eco-Zones**: The creation of pedestrian-friendly areas and green zones should be a core part of urban planning strategies. These zones help reduce vehicle dependency, lower traffic noise, and enhance urban livability.

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