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# ASSESSING THE ENVIRONMENTAL IMPACT OF TRAILER TRANSIT PARKS AT LOKOJA, NIGERIA

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**Abstract**
*Heavy duty vehicles differ from passenger cars in several ways, and these distinctions frequently make them more vulnerable to traffic problems in urban transportation systems. The environmental effects of caravan transit parks in Lokoja, Kogi state, Nigeria, were investigated in this study. The research looks at the environment's various biophysical elements. Counts of heavy duty vehicles at Lokoja's and the surrounding areas along roadside parks, Water quality, soil quality, soil use composition, air quality, and noise quality are among the biophysical components studied. As an exploratory study, the researchers used a variety of data analysis tools and approaches, as well as a variety of sampling strategies. The study's findings were presented in a descriptive manner, and it was discovered that the environmental implications of Lokoja Trailer Transit Park are both positive and negative. Despite the study's findings, the Lokoja Trailer Transit Park must be built because it will improve traffic control in the study area.*

**Key Words:** *Environmental Impacts, Lokoja Trailer Transit Park, Water Quality, Soil Quality, Vegetation Cover Assessment, Air and Noise Quality*

## Introduction

The global economy has benefited from advances in transportation technology and science, but the ecosystem has suffered. Although it frequently pollutes the air and takes up a lot of space, transport is essential to economic development and globalization (Goi, 2017). Even though public subsidies are important, effective transport planning is essential to maintaining traffic and preventing urban sprawl Nwagbara and Iyama (2019). Road infrastructure is thus a part of the framework, the material or financial base of a society or organization. It is a fundamental framework that encourages cities, states, or nations to deliver essential services effectively. For a country to have a strong logistical infrastructure system for various modes of transport, ongoing development from the public and private sectors is required (Onokala and Olajide, 2020).

Infrastructure development is critical for a country's economic development. The physical environment (air, soil, water, vegetation, terrestrial and aquatic ecosystems, and so on), which all contribute to the effects of climate change, is another important factor to consider when developing infrastructure (Ujoh, 2013). As a result, this study describes the current state of the host environment's physical components.

## Methodology

### *Study Area*

Lokoja is located in the lower Niger basin at 7° 45' 27.56" and 7° 51' 04.34"N, and 6° 41' 55.64" and 6° 45' 36.58"E (Figure 1). There are 132,363 people living there and an estimated surface area of 63.82 km$^2$. The population is growing at a 2.5% annual rate. Lokoja, located in the Guinea savanna region, has a typical climate. The average annual temperature does not fall below 27.7 degrees Celsius, and annual rainfall ranges from 1,016 to 1,524 millimetres. The town's western and eastern boundaries are formed by the River Niger and Patti Ridge, respectively. Lokoja is located at the crossroads of the Guinea Savannah (to the north) and tropical rainforest (to the south). Areas prone to salinity/sodicity development, such as fadama soils, have high water tables combined with semi-arid climatic conditions (typically during dry seasons).

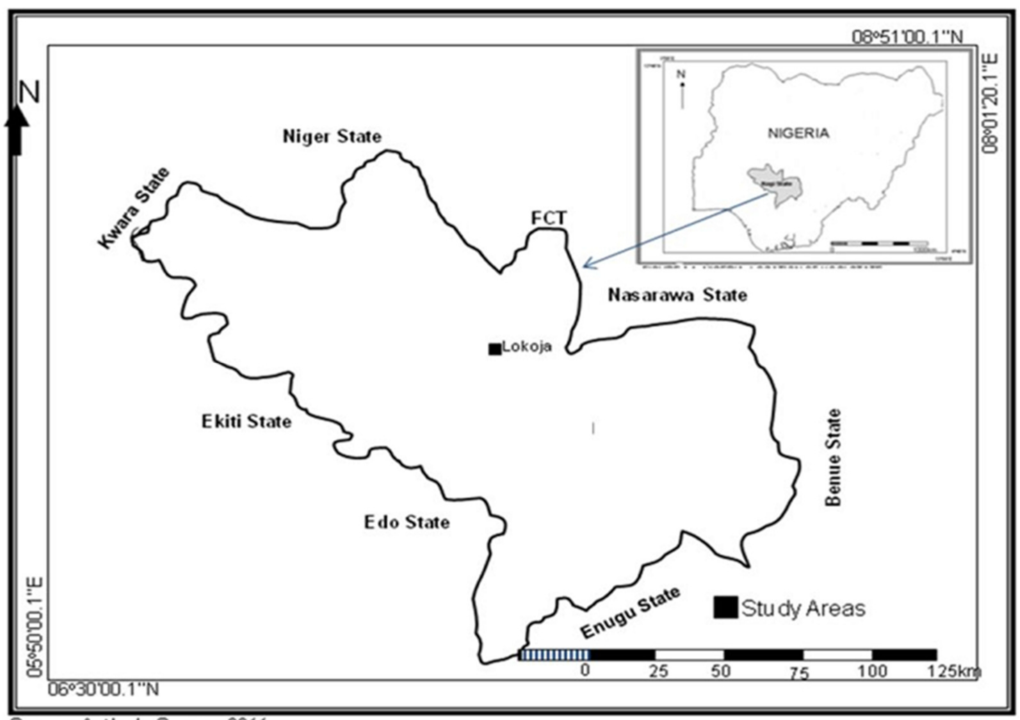


Fig. 1: A map showing the location of Lokoja

The Lokoja Trailer Transit Park is located in Lokoja LGA, Kogi State, along the Lokoja-Abuja Expressway's A2 corridor, among the farmlands of the Ohono Community, about 3 kilometres from the Murtala Mohammed Bridge, and close to the Jamata Inland River Port (since closed) (Figure 2). According to the survey, it covers 40.244 hectares. The images below demonstrate this.


Fig. 2: Location of study site: LTTP at Ohono, in Lokoja LGA, Kogi State

***Samples Collection***
***Water Samples***

Four water samples were collected from the project site and its surroundings. The samples were collected at the Ohono Community's drinking water source and its water source (well). On water samples, 18 different parameters, including heavy metal and physicochemical content, were tested. Purposive sampling was used in the study.

Table 1: Parameters Tested in Water Samples

| S/No. | Parameters |
|---|---|
| 1 | pH |
| 2 | Conductivity |
| 3 | Temperature |
| 4 | Total Dissolved Solids |
| 5 | Dissolved Oxygen |
| 6 | Turbidity |
| 7 | Total Hardness |
| 8 | Chloride |
| 9 | Sulphate |
| 10 | Nitrate |
| 11 | Copper |
| 12 | Chromium (Cr) |
| 13 | Manganese (Mn) |
| 14 | Lead (Pb) |
| 15 | Zinc (Zn) |
| 16 | Iron (Fe) |
| 17 | Alkalinity |
| 18 | Nickel |

The locations of water sample collection were geo-referenced and plotted using handheld GPS technology. Water samples were collected using a simple dip technique and transported to the Kaduna Environmental Protection Authority (KEPA) Laboratory in a preservation cooling box. Each parameter tested in the water samples was given a descriptive statistic. Throughout the data analysis, the mean, minimum and maximum values, standard deviation, and variance were calculated. To identify constituents whose concentrations may jeopardize water quality at the project site, the mean values of the parameters collected for the various sample locations were compared with the various allowed limits of the parameters provided by WHO (2012).

***Soil Samples***

Twenty soil samples were collected at the 40.422 Ha study site. Each area received a sample of topsoil. It demonstrates how the sample point map was made. The experiment site is largely undeveloped, so no control samples were collected. The physical properties of the soil, such as colour, moisture content, soil composition, and oxide and heavy metal concentrations, were examined. Each sample point had nineteen parameters examined.

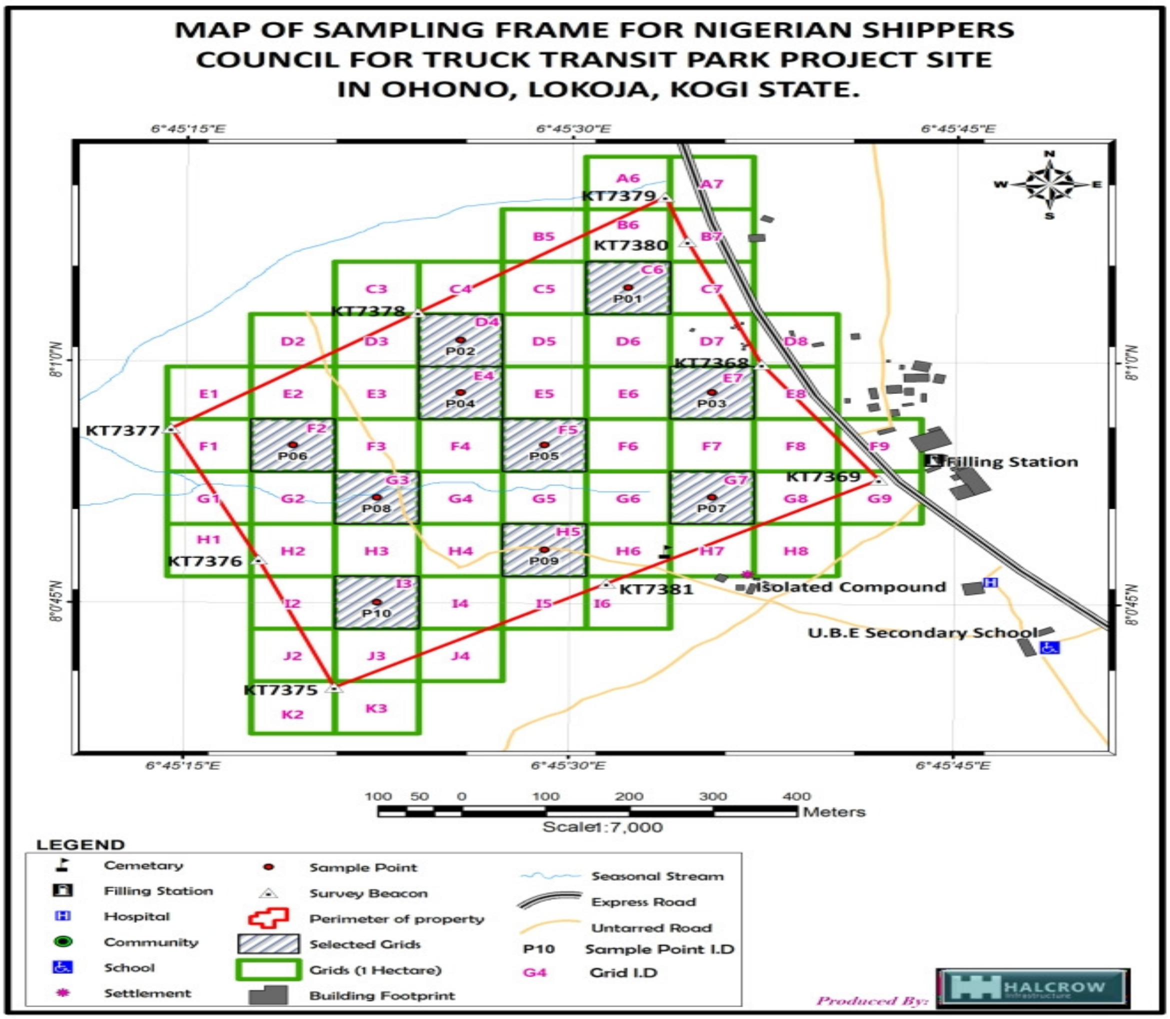


Fig. 3: Map of soil sampling

Table 2: Parameters to be analyzed in soil samples

| S/No. | Parameters (Top-soil) |
|---|---|
| 1 | Appearance |
| 2 | Composition: Clay, Sand, Silt |
| 3 | Moisture Content |
| 4 | Conductivity |
| 5 | pH |
| 6 | Metal: Lead, Cadmium, Zinc, Iron, Calcium, Magnesium, Nickel |
| 7 | Non-Metal: Chlorides, Sulphates, Phosphates, Nitrites |
| 8 | Organic Content |

Each soil sampling site was assigned descriptive statistics for each parameter. The parameters are the average, minimum and maximum values, standard deviation, and variance. The mean values of the data collected for the various sites were compared to the FAO and FMEnv permitted parameters limits in order to identify components capable of causing soil contamination at the project site.

***Air Quality and Noise Pollution Assessment***

The A2 (Lokoja-Abuja highway) is currently the most significant source of noise both inside and outside of the study site. Because most trucks are serviced (in the afternoons) or arrive/depart the 'on-road' truck parking in the early hours of the morning, noise levels at the adjacent roadside truck parking are at their peak.

This study's air quality analysis is critical. This is due to the large amounts of fumes and carbon monoxide expected to be produced by trucks and other hydrocarbon-using equipment at the proposed Lokoja Trailer Transit Park site throughout all study phases. The three current off-road caravan stops in Lokoja, the host village of Ohono, and the study site were chosen as air quality samples. Morning, afternoon, and evening monitoring and analysis of eight air quality parameters and noise levels yielded average values for each parameter.

Table 3: Air Quality & Noise Levels Assessment Parameters at the proposed Lokoja TTP Site

| S/No. | Parameters |
|---|---|
| 1. | Particulate Matter |
| 2. | CO |
| 3. | $CO_2$ |
| 4. | $SO_2$ |
| 5. | $NH_3$ |
| 6. | $NO_2$ |
| 7. | Temperature |
| 8. | Humidity |
| 9. | Noise Level |

***Analysis of Water Samples***

Water quality assessment is critical for ensuring that water sources are safe and suitable for human and environmental use.

Table 4 shows the heavy metal concentrations in water samples. Although the remaining values are below the legal limit, the mean averages for copper and zinc are higher. Two surface water testing results (Copper and Zinc) revealed values above the allowable limit, one of which is the main source of drinking water for the site and flows downstream towards the River Niger, where the second surface water sample was taken.

Table 4: Chemical Content of Surface and Well Water Samples at Proposed LTTP

| Parameters | Chloride | Nitrate | Sulphate | Nickel | Copper | Chromium | Manganese | Lead | Zinc | Iron |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample 1: Site Water Source | 45.67 | 1.0 | 0.00 | 0.012 | 0.041 | 0.021 | 0.00 | 0.031 | 0.105 | 0.314 |
| Sample 2: Olofu River (Downstream) | 39.72 | 1.9 | 0.00 | 0.016 | 0.021 | 0.039 | 0.00 | 0.025 | 0.107 | 0.510 |
| Sample 3: Well Water at Ohono Community | 218 | 0.9 | 0.00 | 0.011 | 0.012 | 0.001 | 0.00 | 0.00 | 0.001 | 0.274 |
| Minimum | 39.72 | 0.9 | 0.00 | 0.011 | 0.0021 | 0.0006 | 0.0042 | 0.0033 | 0.9924 | 0.0041 |
| Maximum | 218 | 1.9 | 0.00 | 0.016 | 0.0661 | 0.0034 | 0.0074 | 0.0072 | 3.0001 | 0.0090 |
| Mean | 101.3 | 1.267 | 0.00 | 0.013 | 0.0213 | 0.0018 | 0.0062 | 0.0049 | 1.9792 | 0.0072 |
| WHO & Nigeria Permissible Limits (mg/L) | 250 | 50 | 250 | 0.02 | 0.02 | 0.05 | 0.1 | 0.01 | 0.01 | 0.1 |
| Remarks | BPL | BPL | BPL | BPL | APL | BPL | BPL | BPL | APL | BPL |

APL = Above Permissible Limit; BPL = Below Permissible Limit; WPL = Within Permissible Limit; NP = Not Provided; NA = Not Applicable; *Based on Mean Values

Lead, zinc, iron, nickel, copper, chromium, manganese, chloride, nitrate, and sulphate are among the elements being researched. The study collected three samples: one from a site water source, one from the Olofu River downstream, and one from an Ohono Community well. The three samples' water quality parameters provide important information about how closely they adhere to predetermined standards. Despite the fact that the majority of parameters, such as chloride, nitrate, sulphate, nickel, chromium, manganese, lead, zinc, and iron, are within allowable limits, the elevated copper concentration in Sample 3 necessitates further investigation. Continuous monitoring and routine evaluations are required to ensure that water sources are portable and secure, as well as to respond quickly to any deviations from acceptable water quality standards (Makanda *et al.*, 2022).

Jaishankar *et al*. (2014) stated that it would be necessary to take the necessary steps to eliminate the sources of these pollutants in areas with abnormally high copper and zinc concentrations. These solutions may include developing and implementing surface or subsurface drainage systems that use both surface and groundwater resources to increase agricultural output year round.

All three samples in Table 5 below are within the WHO's recommended pH range of 6.5-8.5. This shows that the acidity and alkalinity of the water samples are perfectly balanced. The acceptable conductivity ranges of samples 1 and 2 show that the water's ability to carry an electric current is also within acceptable limits. Sample 3 has a higher conductivity level, indicating that it contains more dissolved solids.

TDS levels in samples 1 and 2 are acceptable, but TDS levels in sample 3 exceed the WHO limit of 600 mg/L. High TDS levels can reduce the flavor and palatability of water. The three samples all have acceptable turbidity levels, indicating that there aren't many suspended particles or sediment in the water. The combined hardness levels of all three samples are below acceptable thresholds, indicating that there isn't abundance.

Table 5: Heavy Metals Content in Surface and Well Water Samples at the LTTP site

| Parameters | pH | Conductivity | T°C | DO | TDS | Turbidity (NTU) | Total Hardness | Alkalinity |
|---|---|---|---|---|---|---|---|---|
| Sample 1: Site Water Source | 7.30 | 93 | 16.7 | 7.30 | 100 | 98 | 0.4 | 4.0 |
| Sample 2: Olofu River (Downstream) | 7.50 | 85 | 16.0 | 7.30 | 130 | 99.8 | 0.2 | 3.2 |
| Sample 3: Well Water at Ohono Community | 12.17 | 313 | 18.1 | 6.74 | 1,200 | 108 | 0 | 20.8 |
| *Minimum* | 7.30 | 85 | 16.0 | 6.74 | 100 | 98 | 0 | 3.2 |
| *Maximum* | 12.17 | 313 | 18.1 | 7.30 | 1200 | 108 | 0.4 | 20.8 |
| *Mean* | 8.99 | 163.67 | 16.93 | 7.11 | 476.67 | 101.93 | 0.2 | 9.33 |
| *WHO( 2011) Recommended Values* | *6.5-8.5* | *400* | *NP* | *NP* | *600* | *5* | *200* | *NP* |
| **Remarks* | *WPL* | *BPL* | *NP* | *NP* | *BPL* | *APL* | *BPL* | *NA* |

***Results of Laboratory Analysis of Soil Sample***

The soil properties determined from soil samples taken at the Lokoja Trailer Transit Park site are shown in Table 6. It's worth noting that geological formations have an influence on the occurrence of various oxides in soil, but the amounts are generally minor. Pollutants created by human activity are mostly responsible for higher concentrations.

The results of the analysis show differences in the soil composition, moisture content, conductivity, pH, and metal and nonmetal content of the samples. These changes affect soil fertility, water quality, and potential environmental and health risks. The soils near the LTTP contain significant amounts of heavy metals (particularly lead, zinc, and iron) as shown in table 6. Ona *et al*. (2006) established an acceptable limit for heavy metal concentrations in soil, which was cited by Ujoh and Alhassan (2014). The findings show that the mean values of the three heavy metals are higher than the allowable limits. This is a red warning that has to be addressed if future soil contamination around the LTTP site is to be avoided.

Table 6: Analyzed Parameters in Soil Samples

| Parameters | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Sample 6 | Sample 7 | Sample 8 | Sample 9 | Sample 10 | Permissible Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Appearance | Clay loam | Clay silt | Clay loam | Silt clay | Clay | Clay loam | Clay silt | Clay | Clay loam | Clay | NA |
| % Composition | | | | | | | | | | | |
| *Sand* | 20 | 30 | 60 | 80 | 80 | 10 | 20 | 0 | 80 | 10 | NA |
| *Clay* | 70 | 60 | 30 | 20 | 10 | 90 | 0 | 90 | 20 | 0 | NA |
| *Silt* | 10 | 10 | 10 | 0 | 10 | 0 | 80 | 10 | 0 | 90 | NA |
| Moisture | 1.09 | 0.29 | 0.19 | 0.10 | 0.16 | 1.44 | 2.10 | 3.10 | 0.11 | 0.33 | NA |
| Conductivity | 086 | 060 | 094 | 051 | 126 | 044 | 073 | 089 | 033 | 073 | 0.5-1.0 |
| Ph | 7.05 | 6.51 | 7.23 | 6.30 | 7.92 | 6.14 | 6.78 | 7.15 | 5.91 | 6.76 | 7.0 |
| Metal | | | | | | | | | | | |
| a) Lead (Pb) | 0.0001 | 0.0001 | 4.2014 | 6.8867 | 3.5285 | 0.0001 | 1.7854 | 0.7850 | 0.0001 | 0.0001 | 0.01 |
| b) Cadmium (Cd) | 0.0039 | 0.0001 | 0.0076 | 0.0011 | 0.0085 | 0.0001 | 0.0001 | 0.0001 | 0.0025 | 0.0077 | 1000 |
| c) Zinc (Zn) | 0.0001 | 0.0001 | 0.0001 | 0.4606 | 0.2619 | 0.1525 | 0.1343 | 0.1364 | 0.1259 | 0.0554 | 0.05 |
| d) Iron (Fe) | 205.265 | 115.1081 | 55.5808 | 5419.111 | 4261.327 | 3326.902 | 4.9268 | 133.2377 | 280.9964 | 6.2524 | 6.3 |
| e) Calcium (Ca) | 0.28 | 0.56 | 1.12 | 0.28 | 0.56 | 0.28 | 0.48 | 0.44 | 0.20 | 0.32 | 1000 |
| f) Magnesium (Mg) | 0.0141 | 0.2101 | 0.7710 | 0.4001 | 0.2303 | 0.1814 | 0.2410 | 0.1816 | 0.1801 | 0.1210 | 100 |
| g) Nickel (Ni) | 0.0094 | 0.0001 | 0.0001 | 0.0042 | 0.0001 | 0.0098 | 0.0378 | 0.0369 | 0.0634 | 0.0784 | 35 |
| Non Metals | | | | | | | | | | | |
| a) Chloride (Cl) | 75.99 | 45.99 | 21.99 | 59.99 | 55.99 | 43.99 | 27.99 | 31.99 | 15.99 | 17.99 | NA |
| b) Sulphates ($SO_3$) | 6.1170 | 5.0141 | 6.0410 | 4.3131 | 4.1650 | 3.8160 | 4.0010 | 3.1710 | 6.5151 | 4.8170 | NA |
| c) Phosphate ($PO_4^{3-}$) | 0.4701 | 0.3810 | 1.0414 | 0.7171 | 0.2810 | 0.4601 | 0.6170 | 1.0410 | 0.4140 | 0.5230 | NA |
| d) Nitrites ($NO_2^-$) | 1.3160 | 3.1141 | 1.2810 | 2.4146 | 4.0201 | 1.8810 | 1.4410 | 3.6160 | 1.4138 | 1.6201 | NA |
| Cation Exchange Capacity | 96.0 | 95.4 | 95.3 | 96.0 | 96.0 | 97.0 | 96.1 | 95.5 | 97.0 | 97.0 | NA |
| Effective Cation Exchange Capacity | 1.7 | 1.8 | 1.9 | 1.8 | 1.8 | 1.69 | 1.8 | 2.0 | 2.0 | 1.8 | NA |

***Air Quality and Noise Level Assessment***

Environmental risk factors may be responsible for up to one-fifth of all diseases in developing countries. Disease prevalence is frequently twice as high in developing countries as it is in rich countries, and disease prevalence caused by environmental risk is ten times higher. (WHO, 2006). The poor are disproportionately affected by unsafe drinking water, poor air quality, and chemical exposure (such as pesticides, mercury from illegal mining, and so on) (Ashraf 2014). People recognize the impact of poor environmental conditions on their health and ability to escape poverty (Magaji and Jenkwe, 2020). Despite its remote location, the Lokoja Trailer Transit Park is expected to attract more visitors as more cars gather nearby. Carbon monoxide and other pollutants promote pneumonia and chronic respiratory illness, as well as tuberculosis, low birth weight, and cataracts (Sarasamma and Narayanan, 2014).

The results of the air quality tests show that $SO_2$ and $CO_2$ have mean values that are higher than those allowed by the Nigerian FME. Other elements being studied are ammonia ($HN_3$) in the atmosphere, carbon monoxide (Co), particulate matter (PM), and nitrogen dioxide ($NO_2$) ($NO_2$). Carbon monoxide and other pollutants make pneumonia, chronic respiratory conditions, tuberculosis, low birth weight, and cataracts more likely. The results of these parameters' analyses at various sites teach us about the environment and air quality. Monitoring and maintaining acceptable levels of particulate matter, temperature, humidity, and different gases is critical for ensuring human well-being, preventing air pollution, and promoting sustainable practises. Regular monitoring and adherence to permissible limits can reduce potential health and environmental risks associated with air pollution (Knox *et al*., 2012 and Manisalidis *et al*., 2020).

The decibel range was 92.9 to 139.1 dB (A). Even though there was a lot of noise everywhere, the Murtala Bridge had the most during both daytime hours, especially in the morning. This is understandable given that this is the busiest of Lokoja's three main off-road caravan stops (Table 8). The most peaceful places were Ganaja Park in the morning and Obajana Park in the afternoon. According to statistics, the noise level is high throughout the day. This is unsurprising given the highway's significance as a national thoroughfare. At all sites, noise levels frequently exceed the FME's regulation limit of 90 dB (A) for an 8-hour exposure.

To address these findings, noise regulations and standards that specify acceptable noise levels for different settings and times of day are required (Birma *et al*., 2018). Noise control measures such as the installation of sound barriers, improved traffic management, and strict enforcement of noise-emitting activity can help affected communities foster a more tranquil and long-lasting environment (Olayinka, 2013).

Table 7: Air Quality Assessment at Lokoja

| Locations | | Lokoja Trailer Transit Park Main Site | Ohono Community | Murtala Bridge Park | Okene/ Obajana Park | Ganaja Park | Min | Max | Mean | Remarks | **Permissible Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | Time | | | | | | | | | | |
| Particulate Matter | Morning | 4.4 | 4.9 | 6.9 | 6.4 | 4.9 | 4.4 | 6.9 | 5.6 | BPL | $150\ \mu g/m^3$ - $230\ \mu g/m^3$ |
| | Afternoon | 6.9 | 7.7 | 9.7 | 9.1 | 7.9 | 6.9 | 9.7 | 8.26 | BPL | |
| | Evening | 6.7 | 4.7 | 8.1 | 7.2 | 5.7 | 4.7 | 8.1 | 6.48 | BPL | |
| Temperature (ºC) | Morning | 28.4 | 29.1 | 25.4 | 23.8 | 26.6 | 23.8 | 29.1 | 26.66 | NA | NP |
| | Afternoon | 40.0 | 39.5 | 38.4 | 40.3 | 40.2 | 38.4 | 40.3 | 39.68 | NA | |
| | Evening | 36.3 | 35.9 | 31.2 | 30.7 | 29.9 | 29.9 | 36.9 | 32.8 | NA | |
| Humidity (%) | Morning | 44.6 | 40.9 | 50.3 | 69.8 | 48.8 | 40.6 | 69.8 | 50.88 | NA | NP |
| | Afternoon | 36.6 | 30.0 | 33.1 | 35.2 | 32.1 | 30.0 | 36.6 | 33.4 | NA | |
| | Evening | 47.8 | 41.0 | 45.3 | 46.9 | 40.7 | 40.7 | 47.8 | 44.34 | NA | |
| Carbon Monoxide CO | Morning | 0.20 | 0.198 | 0.20 | 0.01 | 0.10 | 0.01 | 0.2 | 0.142 | BPL | 25 |
| | Afternoon | 0.03 | 0.139 | 0.017 | 0.017 | 0.02 | 0.02 | 0.139 | 0.045 | BPL | |
| | Evening | 0.16 | 0.118 | 0.14 | 0.11 | 0.96 | 0.11 | 0.96 | 0.298 | BPL | |
| Carbon Dioxide | Morning | 0.20 | 0.09 | 0.18 | 0.08 | 0.12 | 0.08 | 0.20 | 0.134 | BPL | 350-450 pm |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $CO_2$ | Afternoon | 0.05 | 0.119 | 0.168 | 0.13 | 0.14 | 0.05 | 0.168 | 0.121 | BPL | |
| | Evening | 0.11 | 0.178 | 0.196 | 0.05 | 0.11 | 0.05 | 0.196 | 0.13 | BPL | |
| Sulfur Dioxide $SO_2$ | Morning | 0.03 | 0.03 | 0.60 | 0.02 | 0.02 | 0.02 | 0.60 | 0.14 | APL | 0.01 - 0.1 pm |
| | Afternoon | 0.01 | 0.02 | 0.03 | 0.03 | 0.01 | 0.01 | 0.03 | 0.02 | WPL | |
| | Evening | 0.02 | 0.03 | 0.082 | 0.03 | 0.03 | 0.02 | 0.082 | 0.038 | WPL | |
| Nitrogen Dioxide $NO_2$ | Morning | 0.04 | 0.15 | 0.04 | 0.04 | 0.03 | 0.03 | 0.15 | 0.06 | APL | 0.06 pm |
| | Afternoon | 0.03 | 0.312 | 0.04 | 0.04 | 0.03 | 0.03 | 0.312 | 0.09 | APL | |
| | Evening | 0.04 | 0.17 | 0.03 | 0.03 | 0.02 | 0.02 | 0.17 | 0.058 | APL | |
| Ammonia $NH_3$ | Morning | 0.02 | 0.19 | 0.03 | 0.01 | 0.02 | 0.01 | 0.19 | 0.054 | BPL | 25 |
| | Afternoon | 0.01 | 0.198 | 0.02 | 0.03 | 0.02 | 0.01 | 0.198 | 0.199 | BPL | |
| | Evening | 0.02 | 0.16 | 0.03 | 0.03 | 0.03 | 0.02 | 0.16 | 0.054 | BPL | |

Table 8: Noise Levels at the Study Area

| Sample Points | Main Lokoja Trailer Transit Park site | Ohono Community | Murtala Bridge Park | Okene/Obajana RD Park | Ganaja Park |
|---|---|---|---|---|---|
| Morning (6am-8.30am) | | | | | |
| Noise Level | 115.4 | 110.9 | 139.1 | 100.0 | 103.0 |
| Afternoon (1pm-3.30pm) | | | | | |
| Noise Level | 101.3 | 100.3 | 115.8 | 109.7 | 92.9 |
| Evening (7pm-9.30pm) | | | | | |
| Noise Level | 97.1 | 98.5 | 126.4 | 101.9 | 109.2 |

### *Vegetation Assessment*

To address these findings, it is critical to develop and implement noise regulations and standards that specify acceptable noise levels for different settings and times of day (Birma *et al*., 2018). Noise control measures such as the installation of sound barriers, improved traffic management, and strict enforcement of noise-emitting activity can help impacted communities foster a more tranquil and long-lasting environment (Olayinka, 2013).

Table 9: Land Cover Quantification of the LTTP Site and Environ

| S/No. | Land cover category | Area ($m^2$) | Percentage (%) |
|---|---|---|---|
| 1 | Sparse Vegetation | 303131.166 | 8.435 |
| 2 | Scattered Cultivation/Bare Surface | 1750136.701 | 48.698 |
| 3 | Thick Vegetation | 787249.469 | 21.905 |
| 4 | Impervious Surface | 360191.150 | 10.022 |
| 5 | Water body | 393178.953 | 10.940 |
| | Total | 3,593,887.438 | 100 |

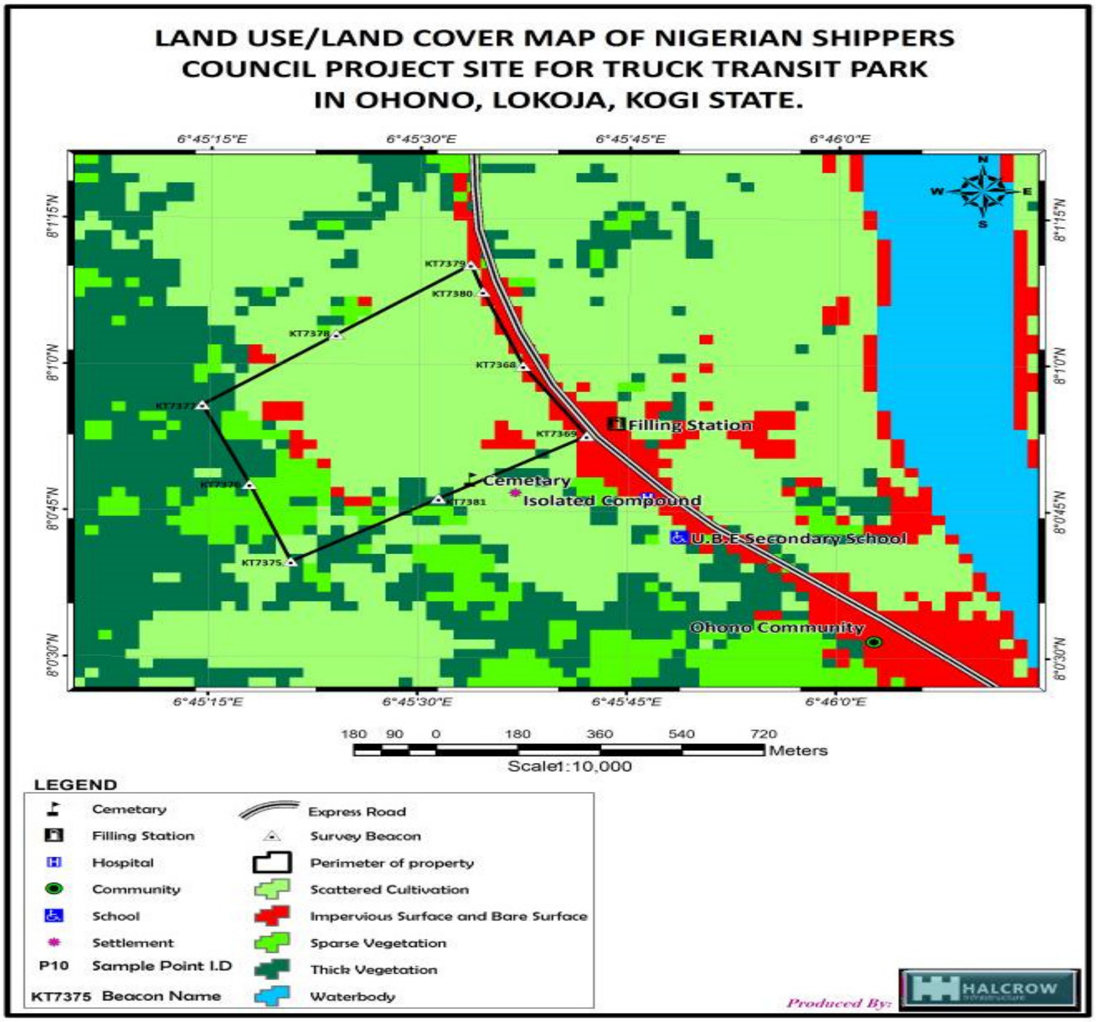


Fig. 4: Land cover map of the study area

***Analysis of Land Use and Coverage***

The vegetation cover was assessed using the normalized difference vegetation index (NDVI), land use/cover (LU/C), land surface temperature (LST), and the study area's surroundings. Satellite images of the intended research site and its surroundings were used to accomplish this.

The loss of shrubs and trees, which contribute to a reduction in emitted long-wave radiation and provide natural cooling through shade and evapotranspiration, is one of the most visible effects of man-made environmental changes (Pickett *et al*., 2001; Jenkwe and Iyeh, 2020). Heat concentration and vegetation quality around the LTTP site are assessed using LST estimation (Figure 4) and NDVI extraction.

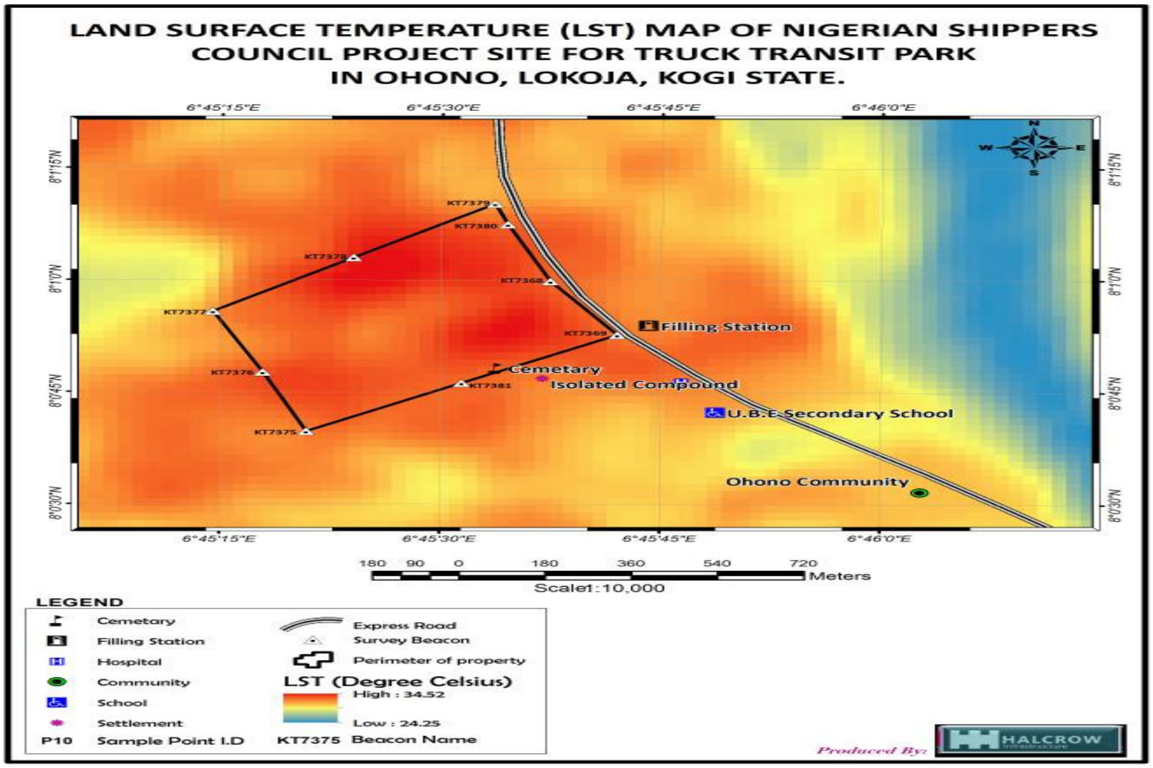

Fig. 5: LST map of the study area

The LST estimates the LST-vegetation link using the NDVI as an indicator of plant abundance because it is one of the fundamental factors in the physics of land-surface processes. The temperature inside the displayed zone ranges from 34.52°C to 24.25°C. The NDVI, on the other hand, is nearly average, with the majority of the Lokoja Trailer Transit Park falling between 0.5 and 0.7, indicating a lack of plant cover.

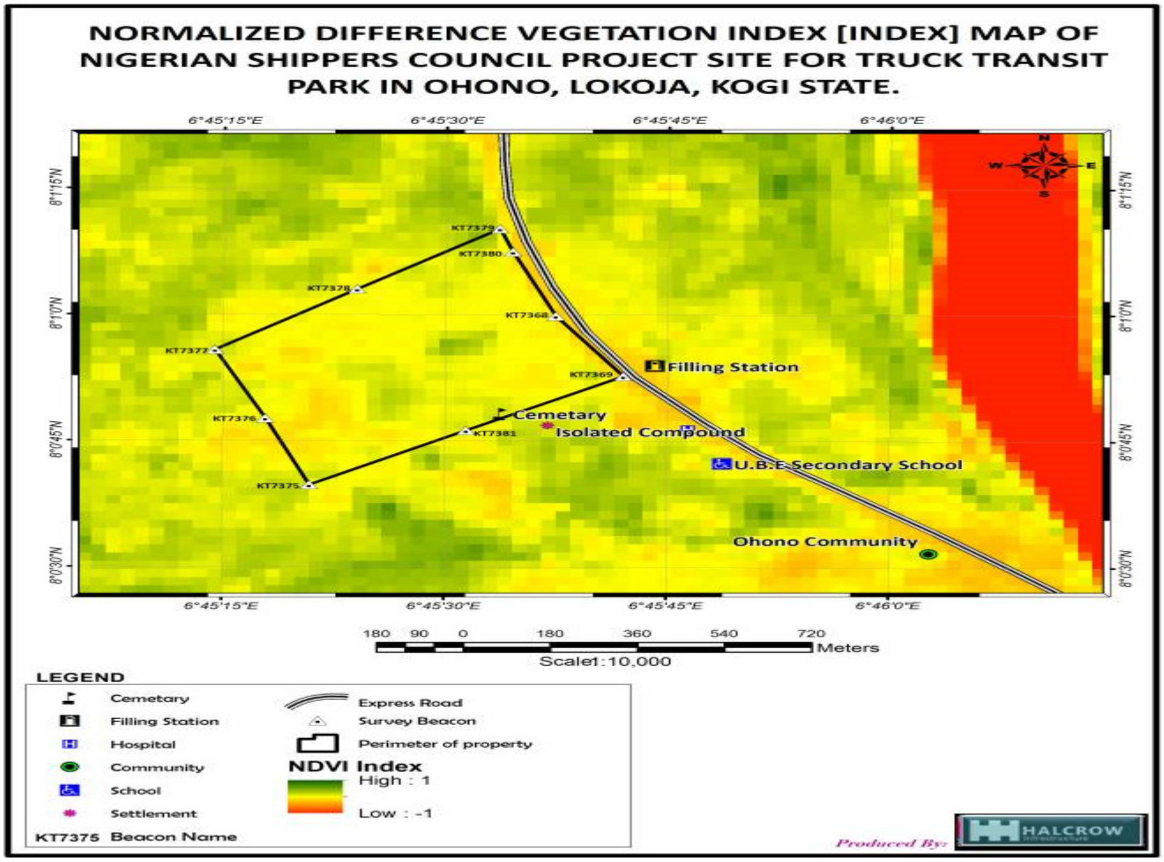


Fig. 6: NDVI map of the study area

***Heavy Goods Vehicle Count***

The preliminary HGV traffic count shows a high volume of HGVs entering and leaving Lokoja via the three main access roads (Lokoja-Abuja, Lokoja-Okene/Obajana, and Lokoja-Ajaokuta). The Lokoja-Abuja exit/entry route has the most HGVs, accounting for 46.6 % of all 5,414 movements. Given that road transport accounts for roughly 90% of the transport sub-share sector's national GDP (3%) in Lokoja, a TTP in such a critical location would be considered a fair investment if the necessary efforts are made to build an operational, functional, and 'fail-safe' model.

Table 10: Heavy Goods Vehicle (HGV) Traffic Count at Lokoja, Kogi State.

| Location | Abuja Road (A2) | | | Ajaokuta Road | | | Okene/Obajana Road | | |
|---|---|---|---|---|---|---|---|---|---|
| Day | Day 1 | Day 2 | Day 3 | Day 1 | Day 2 | Day 3 | Day 1 | Day 2 | Day 3 |
| 8-10am In-bound | | | | | | | | | |
| Lorries | 45 | 49 | 39 | 5 | 8 | 7 | 18 | 28 | 11 |
| Trailers | 45 | 48 | 58 | 22 | 19 | 16 | 84 | 88 | 57 |
| Tankers | 43 | 51 | 49 | 4 | 11 | 5 | 11 | 13 | 38 |
| *Sub-total* | *133* | *148* | *146* | *31* | *38* | *28* | *113* | *129* | *106* |
| 8-10am Out-bound | | | | | | | | | |
| Lorries | 48 | 46 | 51 | 5 | 6 | 7 | 20 | 29 | 18 |
| Trailers | 55 | 52 | 62 | 20 | 20 | 24 | 72 | 83 | 74 |
| Tankers | 16 | 13 | 15 | 6 | 8 | 3 | 35 | 35 | 29 |
| *Sub-total* | *119* | *111* | *128* | *31* | *34* | *34* | *127* | *147* | *121* |
| 12-2pm In-bound | | | | | | | | | |
| Lorries | 45 | 49 | 53 | 6 | 8 | 4 | 14 | 12 | 19 |
| Trailers | 33 | 34 | 44 | 21 | 19 | 25 | 50 | 49 | 45 |
| Tankers | 20 | 16 | 27 | 5 | 3 | 4 | 21 | 18 | 23 |
| *Sub-total* | *98* | *99* | *124* | *32* | *30* | *33* | *85* | *79* | *87* |
| 12-2pm Out-bound | | | | | | | | | |
| Lorries | 51 | 40 | 48 | 3 | 1 | 5 | 18 | 20 | 21 |
| Trailers | 30 | 36 | 27 | 22 | 18 | 26 | 57 | 67 | 63 |
| Tankers | 27 | 25 | 24 | 6 | 9 | 8 | 19 | 21 | 15 |
| *Sub-total* | *108* | *101* | *99* | *31* | *28* | *39* | *94* | *108* | *99* |
| 4-7pm In-bound | | | | | | | | | |
| Lorries | 60 | 54 | 72 | 5 | 8 | 4 | 19 | 16 | 19 |
| Trailers | 76 | 68 | 87 | 29 | 28 | 33 | 104 | 101 | 104 |
| Tankers | 35 | 39 | 30 | 6 | 8 | 5 | 31 | 27 | 31 |
| *Sub-total* | *171* | *151* | *189* | *40* | *44* | *42* | *154* | *144* | *149* |
| 4-7pm Out-bound | | | | | | | | | |
| Lorries | 68 | 79 | 76 | 4 | 11 | 9 | 32 | 38 | 28 |
| Trailers | 60 | 80 | 82 | 29 | 34 | 34 | 109 | 117 | 101 |
| Tankers | 42 | 59 | 51 | 11 | 9 | 16 | 24 | 18 | 11 |
| *Sub-total* | *170* | *218* | *209* | *44* | *54* | *59* | *165* | *173* | *140* |
| | 799 | 828 | 895 | 209 | 228 | 235 | 738 | 780 | 702 |
| Grand Total | 14.76% | 15.30% | 16.53% | 3.86% | 4.21% | 4.34% | 13.63% | 14.41% | 12.97% |

Total Vehicle Count = 5,414

These findings have implications for road infrastructure development, traffic management, and transportation planning. Authorities can make well-informed decisions about road improvements, traffic control measures, and resource allocation by understanding traffic patterns, peak times, and vehicle make-up (Leitner *et al*., 2022).

## Conclusion and Recommendations

This analysis identifies the Lokoja Trailer Transit Park study area in Ohono Community, Lokoja LGA, Kogi State, as having potential primary impacts. The expected effects have been identified and described in various sections of this paper. Mitigation strategies, including extensive environmental monitoring, have been proposed for each expected impact during the various study phases. The variables are estimated to have significant positive and negative effects on the immediate environment.

Finally, as mentioned in this paper, the Lokoja Trailer Transit Park has limited negative environmental implications. Although, the benefits of traffic management, urban expansion, a lower noise concentration than the Murtala bridge park, and a reduction in the danger of accidents caused by truck parking on current highways, support transit, support equity objectives, revenue generation and improved service quality should far exceed the environmental costs. At this point, it has been determined that the Lokoja Trailer Transit Park will significantly enhance traffic management in the study region and is thus worthwhile.

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