International Journal of Management Sciences Vol. 9No 1 June 2016 page 89- 104

HEALTH IMPACT ASSESSMENT OF ROAD REHABILITATION ON AIR AND NOISE. (CASE STUDY OF MILE 12 - IKORODU EXPRESS ROAD)

BY
ADEWARA M. B. AND ADEDOKUN M. A
DEPARTMENT OF SURVEYING AND GEOINFORMATICS, FEDERAL POLYTECHNIC, ILARO, OGUN STATE.

Corresponding Author Email:thawben@gmail.com

Abstract

Clean air is considered to be a basic requirement of human health and well-being. However, air pollution continues to pose a significant threat to health worldwide. (WHO, 2005). One of the earliest tasks in planning a road scheme is to determine whether or not it should be subject to Environmental Impact Assessment, EIA. The overriding consideration in determining whether a road scheme should be subject to EIA is the likelihood of significant environmental effects. The aim of this paper is to assess the Health Impact of Road Expansion on air and noise using Mile 12 – Ikorodu road as a case study. It covers a total distance of about 13.5km, staring from and terminating at the Ikorodu round about. The impact of road expansion exercise such as increasing traffic congestion; increasing rates of traffic-related emission and atmospheric pollution on the socio-economic activities as well as several ecological disturbances to the human health are assessed. Grid coordinates of each sampling location was determined using hand held Global Positioning System equipment (Garmin GPS MAP76). ArcGIS and Excel spreadsheet are the software used for the data analysis. Although no mitigation measure is required for this impact of increasing population, from the viewpoint of the project proponent. The result of the analysis indicates that Noise and Air quality being generated during and after the expansion is insignificantly low in comparison to the environmental standards.

Keywords:

Health Impact Assessment (HIA), Road construction and rehabilitation, Traffic-related emission, atmospheric pollution, Noise pollution, socio-economic activities.

1.0 INTRODUCTION

Lagos is considered to be the sixth largest city and one of the most rapidly urbanizing metropolitan areas of the world. With a population that is variously estimated at between 12.5 and 15 million and an annual growth rate of nearly 6%, it is also one of the world's mega cities. Geographically, the metropolitan area of Lagos is also fast spreading, now extending beyond the borders of Lagos State into the neighboring Ogun state in the north. As a result of this spread, road constructions and rehabilitation are therefore growing both in length and number.

This road constructions and rehabilitation, (Mile –Ikorodu road as case study) combined with inadequate or poorly executed development plans, has given rise to numerous environmental

problems along the Mile 12- Ikorodu corridor. These include worsening state of disrepair of roads; deteriorating physical attractiveness and rising levels of road accidents and increasing rates of traffic-related emission and atmospheric pollution. Also, due to the high level of socio-economic activities within this area, there is almost a continuous heavy stream of people along the Mile 12-Ikorodu corridor which brings about traffic jams especially at peak periods.

These traffic issue challenges that are directly related to the sprawling Ikorodu urbanization are further aggravated by its status as one of the state's new focus for economic, commercial and industrial center.

In this research, these environmental problems have been attended to from Environmentalist perspective.

1.1 RESEARCH PROBLEMS

Health impact assessment (HIA) provides political decision-makers with quantitative and qualitative information about how any policy, program or project may affect the health of people. In respect of the health consequences of air pollution levels, HIA aims to elucidate current effects or, state differently, the improvement in health that might be expected through reductions in air pollution.(WHO, 2005)

Due to the high level of socio-economic activities within this study area, there is almost a continuous heavy stream of people along the Mile 12-Ikorodu corridor which brings about traffic jams especially at peak periods. This results in heavy gaseous vehicular exhausts in the air. In a view to make this heavy stream of people flow freely without any hitch, the vision for Metropolitan Lagos has deemed it fit to provide a modern integrated multi-modal transport system that will make Metropolitan Lagos a world class city; a welcome development which brought about the birth of rehabilitation of Lagos roads, thus, the expansion and rehabilitation of the Mile 12 – Ikorodu road.

However, the proposed expansion exercise may result in some health hazards, which may be experienced in the form possible pollution of air, water, soil and increase in noise level amongst others and other anthropological issues.

These may negatively impact environmental resources and human health.

1.2 BENEFITS OF CONDUCTING HIA

There are several benefits of conducting HIA.

I. Specific adverse health outcomes can be quantitatively linked to a given air pollutant and the magnitude of health effects associated with changes in air pollution can be determined.

II. The information can usefully be put towards providing cost-effective improvements in public health.

III. The assessment can identify critical uncertainties and suggest productive areas of research.

1.3 LIMITATIONS OF THE PROJECT

The study focused on evaluating the potential Health impacts on the communities along the corridor due to road expansion activities. A number of limited resources have constrained this study viz: fund, data, manpower and so on. As a result the limitations of the project has been highlighted as follows –

- Ten locations along the corridor is being considered for this assessment
- Air quality and Noise level components of the environment are considered.

TABLE 1.1: List of Tested Parameters

AIR	NOISE
SPM µs/m	-
CO ppm	-
NO2	-
Total Hydrocarbon THC ppm	-
NH3 Ppm	-
SO2 ppm	-
H2S ppm	-

(ADEWARA M.B & ADEDOKUN M.A, 2014)

1.4 AIM AND OBJECTIVES OF THE PROJECT

The aim of the project is to assess the Health Impact of road expansion on air and noise from Mile 12 to Ikorodu. This aim is set to be actualized through a number of objectives namely:

- To identify and acquire from field data and reliable sources the Biophysical and Anthropogenic phenomena along the road corridor.
- To develop a GIS database for the Biophysical and Anthropogenic information about the study area;
- To identify areas that are prone to adverse health effects during the expansion;
- To determine spatial efficiency (in terms of geographical coverage) of the existing road in the study area;

- To assess potential impacts the road expansion may have on the communities along the road corridor.

1.5 DATA SOURCES

1 Lagos Metropolitan Area Transport Authority (LAMATA)
2 Field test results (Civil Engineering Laboratory, University of Lagos)
3 Federal Ministry of Environment (Environmental Standards)
4 Google earth Imageries (2012 and 2014)

1.6 THE STUDY AREA –MILE 12 TO IKORODU ROAD CORRIDOR

The study area comprises of the 50m buffer along both sides of the Mile 12- Ikorodu Road corridor originating from Mile 12 (6.60605N 3.39918E) to Ikorodu Town (6.62032N 3.50340E) covering about approximately 13.5 km in length. It is located in the north east of the state connecting Lagos metropolis to Ikorodu suburb (fig.1). The corridor is best illustrated by the random distribution of a number of bus stops, which were key niches for socio-economic activities. The bus stop locations are indication of proximity to settlements or buildup communities.

In this respect ten Bus stops were selected along the corridor, namely:

- Mile 12
- Owode Onirin
- Thomas
- Itowolo
- Idiroko
- Majidun
- Ogolonto
- Agric
- Haruna
- Ikorodu

FIGURE 1.1:LOCATION MAP OF THE PROPOSED ROAD EXPANSION FROM MILE 12 TO IKORODU (LAGOS METROPOLITAN AREA TRANSPORT AUTRHORITY, 2010)

2.0 RESEARCH METHODOLOGY

In order to actualize the aim of the objectives of this work, field reconnaissance was carried out to have an understanding of the properties of the road and in order to obtain an accurate picture of the various ecosystem types and their dynamics.

Extensive reconnaissance of the project area and surrounding communities by motor vehicle and foot were undertaken on the first four days of the study. Air and Noise sampling points, socio-economic and health data gathering areas were established based on this investigative survey. The study area and control points adequately encompassed the proposed project location with sufficient buffer to capture the extreme boundaries of environmental influence which the project construction, operation and maintenance activities may possibly have. The grid coordinates of each sampling location was determined using hand held global positioning system equipment Garmin GPS MAP 76.

2.1 DATA SOURCES

Sources of data for this research work are:

1. Lagos Metropolitan Area Transport Authority (LAMATA)
2. Test results of Field sample survey (Civil Engineering Laboratory, University of Lagos)
3. Federal Ministry of Environment (Environmental standards)

2.2 EQUIPMENT

Equipment for the field data acquisition are:

1. Ambient air Analyzer for air sampling
2. Pulsar outdoor monitoring kit for noise assessment
3. Hand held global positioning system equipment (Garmin GPS MAP 76.)

2.3 SOFTWARE

Software used for data analysis and reporting are:

1. Microsoft word
2. Excel spreadsheet
3. ArcGIS 10.2

2.4 DATA ACQUISITION

Information presented in this report was acquired from literature review and the results of field investigations and laboratory analysis. Selected locations at proximity to road junctions were also given consideration because such locations contribute more to traffic congestion or decongestions and this would aid in air quality analysis.

Table 1.2: Air Sample data before road expansion

Bus stop	SPM µg/m^3	CO PPM	NO_2 PPM	THC PPM	NH_3 PPM	SO_2 PPM	H_2S PPM	EASTING	NORTHING
Mile 12	180	4.02	0.14		0	0	0	544061.420	730277.310
Owode Onirin	131.1	4.2	0.03	1.05	0.011	0.009	0.021	545462.010	730714.480
Thomas	212.3	5.47	0.03	0.45	0.021	0	0.012	547148.380	730551.530
Itowolo	210	4.3	0.04	0	0	0	0	547920.560	730584.380
Idiroko	188.2	6.4	0.014	0.06	0	0	0.021	550699.120	731715.830
Majidun	117.8	2.9	0.17	1	0	0	0	551986.650	731710.650
Ogolonto	299.98	9.89	0.19	0.18	0.001	0.001	0.007	552531.650	731704.020
Agric	100.8	8.1	0.1	0	0	0	0	553574.940	732400.310
Haruna	201.21	9.86	0.1	0	0.021	0	0.005	554640.740	732248.780
Ikorodu	132.9	8.97	0.2	0	0	0	0	555652.530	731812.870

LAMATA July 2010

Table 1.3: Air Sample data after road expansion

BUS STOP	SPM µg/m^3	CO PPM	NO_2 PPM	THC PPM	NH_3 PPM	SO_2 PPM	H_2S PPM	EASTING	NORTHING
Mile 12	183	3.7	0.1	0.76	0	0	0.016	544061.420	730277.310
Owode Onirin	113.6	5.2	0.06	0.55	0	0.006	0.014	545462.010	730714.480
Thomas	122.1	4.87	0.07	0	0	0	0.015	547148.380	730551.530
Itowolo	178.2	3.2	0.01	0	0	0	0.009	547920.560	730584.380
Idiroko	98.2	4.3	0.03	0.08	0	0	0.021	550699.120	731715.830
Majidun	110.4	2.8	0.1	0	0	0	0.019	551986.650	731710.650
Ogolonto	305	9.6	0.26	0.08	0	0.001	0.02	552531.650	731704.020
Agric	92.1	3.24	0.05	0.06	0	0.002	0.083	553574.940	732400.310
Haruna	100.21	8.61	0.1	0	0	0	0.005	554640.740	732248.780
Ikorodu	135.3	3.588	0.06	0.6	0	0	0	555652.530	731812.870

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Table 1.4: Noise Sample data before road expansion

Bus stop	NOISE (db)	EASTING	NORTHING
Mile 12	77.5	544061.420	730277.310
Owode Onirin	76.4	545462.010	730714.480
Thomas	82.2	547148.380	730551.530
Itowolo	81.5	547920.560	730584.380
Idiroko	76.4	550699.120	731715.830
Majidun	85.2	551986.650	731710.650
Ogolonto	79.9	552531.650	731704.020
Agric	88.5	553574.940	732400.310
Haruna	87.2	554640.740	732248.780
Ikorodu	77.8	555652.530	731812.870

LAMATA July 2010

Table 1.5: Noise Sample data after road expansion

Bus stop	NOISE (db)	EASTING	NORTHING
Mile 12	76.6	544061.420	730277.310
Owode Onirin	79.8	545462.010	730714.480
Thomas	81.4	547148.380	730551.530
Itowolo	68.5	547920.560	730584.380
Idiroko	71.2	550699.120	731715.830
Majidun	70.3	551986.650	731710.650
Ogolonto	80.1	552531.650	731704.020
Agric	73.3	553574.940	732400.310
Haruna	80.1	554640.740	732248.780
Ikorodu	77	555652.530	731812.870

ADEWARA M. B. AND ADEDOKUN M. A, July 2014

2.4.1 Air Measurement Procedure

2.4.1.1 Total Hydrocarbon (THC) procedures

The measurement of total hydrocarbon sample content was made by gas alert micro 5 instrument using the heated flame ionization detector (FD) between the electrodes of which passes an ionization current proportional to the mass rate of hydrocarbon entering a hydrogen flame. The analyzer machine deemed to

include components arranged to control temperature and flow rates of sample. Sample by pass, fuel and diluents gases, and to enable effective span and zero calibration checks.

2.4.1.2 CO and H_2S Procedures

Gas alert micro 5 which utilizes differential energy absorption in parallel reference and sample gas cells, was used for sampling Co in the air. The cell or group of cells of each of these gas constituents are being sensitized appropriately.

2.4.1.3 NO_2 Analyzer

The measurement of NO2 concentration was made by the chemiluminescent method in which the measure of the radiation intensity emitted during the reaction of the NO. The NO2 component then converted to NO in a converter of the requisite efficiency prior to measurement.

2.4.2 Noise Measurement Procedures

Using 94dB as specified by the manufacturer, the noise instrument was oriented in a known direction so that the maximum sound received arrives as nearly as reasonable in the direction for which the instrument are calibrated

The instrument was placed so that their sensing elements are approximately 1.2m (4ft) above ground either by hand held measurement.

A recorded acoustic calibration of the system was made in the field (Immediately prior to and after each test)with an acoustic calibrator for the two purposes of checking system sensitivity and providing an acoustic reference level for the analysis of the sound level data.

The ambient noise, including both acoustical background and noise from the household equipment which as well as contributing to the noise measurement systems, shall be recorded and determined in the test area with the system gain set at levels which will be used for base station noise measurements.

2.5 DATA BASE CREATION

The outcomes from laboratory result were collected and a database created. In the creation of the database, both spatial and attribute data were structured in excel spreadsheet. The structured database where imported in ArcGIS 10.2 for spatial and statistical analysis to be performed on them.

A comparison of the data from Lagos Metropolitan Area Transport Authority (LAMATA) in 2012 at the inception of the project was compared with the recent data from the study area in 2014. The sets of data show that in the overall, there is little or no serious negative impact on the route.

2.6 DATA ANALYSIS

The most critical impacts of project operation on air quality and noise levels are expressed during operations. Basically, the fact that the road will be wider and in better shape will encourage an increase in the number of vehicles that will ply the route.

2.6.1 Assessment of Air Quality

By expansion, there is higher gaseous emission and the associated environmental impacts, in the form of NO_2, SO, CO and hydrocarbons. The main impacts of site restoration activities on air quality will be in terms of gaseous emissions and suspended particulate. The various vehicles and machinery that were been used during the various stages of decommissioning and site restoration emit various gaseous pollutants such as NO_2, SO_2, CO, etc. which could have serious negative effects on air quality and human health. But in a short term, by comparison of the air data (both before and after road expansion) gathered from the field, it appears that the air quality before and after the expansion exercise are within environmental standards set by the Federal Ministry of Environment.

Figure 2.1 below is one of the analyses showing query for Bus stop locations whose Carbon Monoxide is above 10 PPM Environmental standard. In the figure, all the bus stops highlighted imply that they are below 10 PPM. The same procedure was applied to analyse other constituents of air and noise

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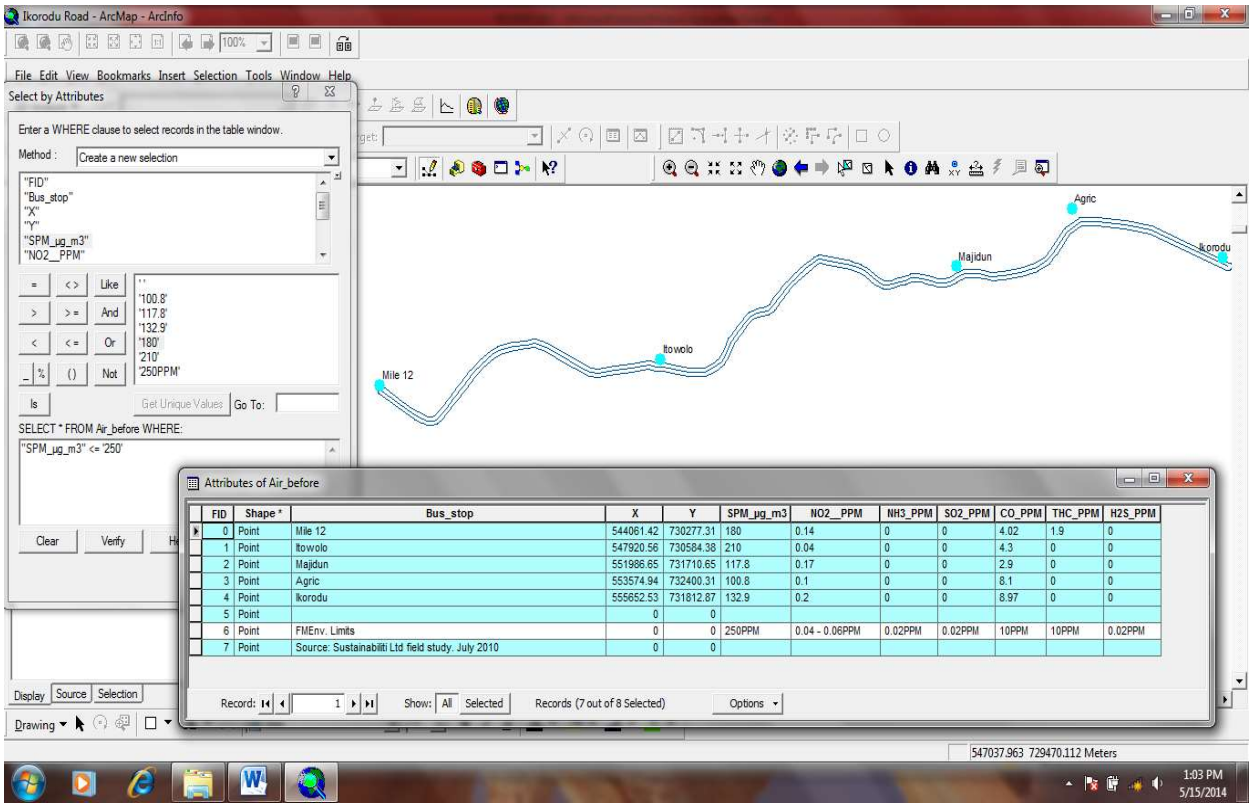
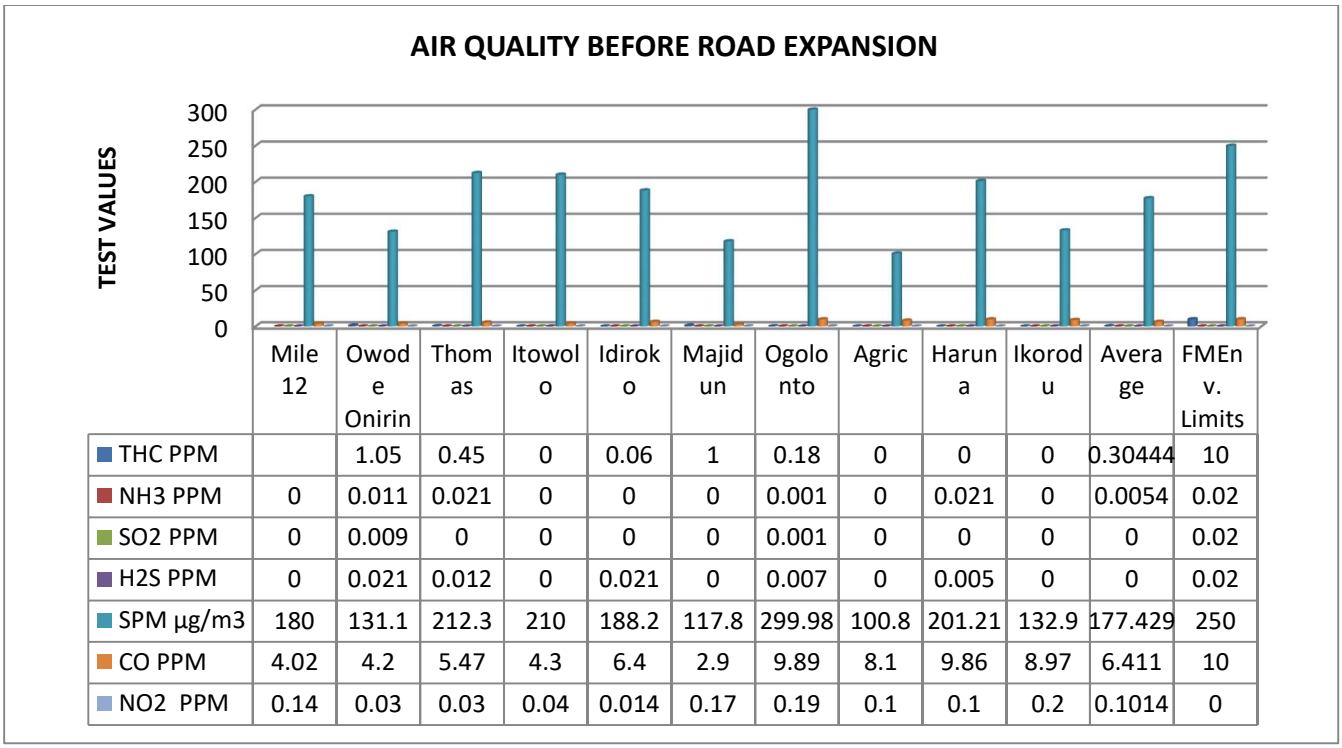


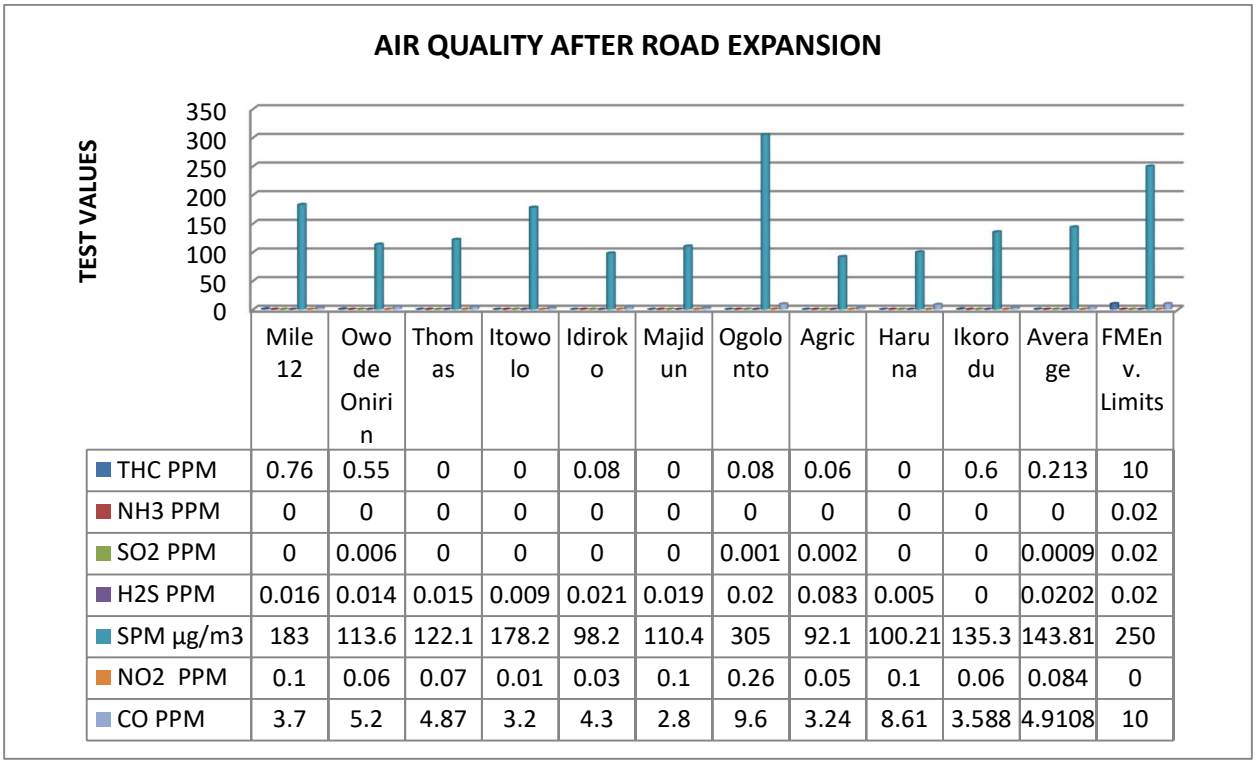
FID	Shape *	Bus_stop	X	Y	SPM_µg_m3	NO2__PPM	NH3_PPM	SO2_PPM	CO_PPM	THC_PPM	H2S_PPM
0	Point	Mile 12	544061.42	730277.31	180	0.14	0	0	4.02	1.9	0
1	Point	Itowolo	547920.56	730584.38	210	0.04	0	0	4.3	0	0
2	Point	Majidun	551986.65	731710.65	117.8	0.17	0	0	2.9	0	0
3	Point	Agric	553574.94	732400.31	100.8	0.1	0	0	8.1	0	0
4	Point	Ikorodu	555652.53	731812.87	132.9	0.2	0	0	8.97	0	0
5	Point		0	0							
6	Point	FMEnv. Limits	0	0	250PPM	0.04 - 0.06PPM	0.02PPM	0.02PPM	10PPM	10PPM	0.02PPM
7	Point	Source: Sustainabiliti Ltd field study. July 2010	0	0							

Fig 2.1: Query analysis of Air quality at the selected sample locations



	Mile 12	Owode Onirin	Thomas	Itowolo	Idiroko	Majidun	Ogolonto	Agric	Haruna	Ikorodu	Average	FMEnv. Limits
THC PPM		1.05	0.45	0	0.06	1	0.18	0	0	0	0.30444	10
NH3 PPM	0	0.011	0.021	0	0	0	0.001	0	0.021	0	0.0054	0.02
SO2 PPM	0	0.009	0	0	0	0	0.001	0	0	0	0	0.02
H2S PPM	0	0.021	0.012	0	0.021	0	0.007	0	0.005	0	0	0.02
SPM µg/m3	180	131.1	212.3	210	188.2	117.8	299.98	100.8	201.21	132.9	177.429	250
CO PPM	4.02	4.2	5.47	4.3	6.4	2.9	9.89	8.1	9.86	8.97	6.411	10
NO2 PPM	0.14	0.03	0.03	0.04	0.014	0.17	0.19	0.1	0.1	0.2	0.1014	0

Fig 2.2: Showing graph for Air Quality at the selected locations before road expansion

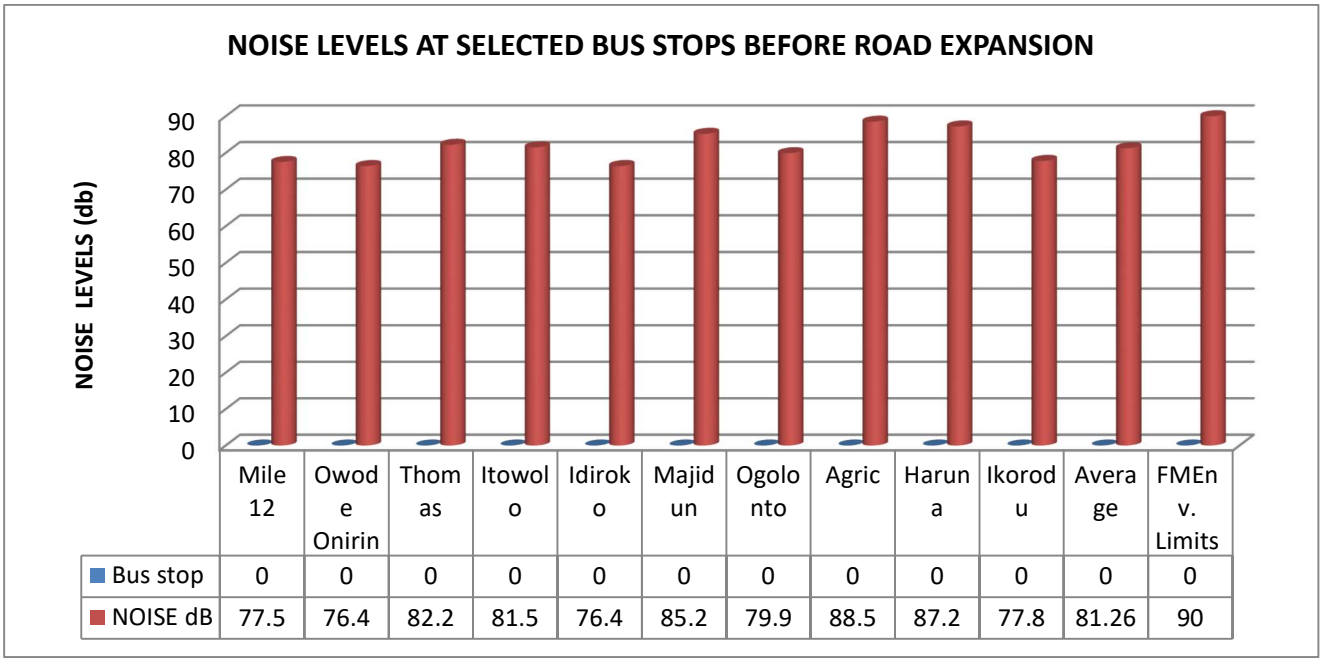


	Mile 12	Owode Oniri n	Thomas	Itowolo	Idiroko	Majidun	Ogolonto	Agric	Haruna	Ikorodu	Average	FMEnv. Limits
THC PPM	0.76	0.55	0	0	0.08	0	0.08	0.06	0	0.6	0.213	10
NH3 PPM	0	0	0	0	0	0	0	0	0	0	0	0.02
SO2 PPM	0	0.006	0	0	0	0	0.001	0.002	0	0	0.0009	0.02
H2S PPM	0.016	0.014	0.015	0.009	0.021	0.019	0.02	0.083	0.005	0	0.0202	0.02
SPM µg/m3	183	113.6	122.1	178.2	98.2	110.4	305	92.1	100.21	135.3	143.81	250
NO2 PPM	0.1	0.06	0.07	0.01	0.03	0.1	0.26	0.05	0.1	0.06	0.084	0
CO PPM	3.7	5.2	4.87	3.2	4.3	2.8	9.6	3.24	8.61	3.588	4.9108	10

Fig 2.3: Showing graph for Air Quality at the selected locations after road expansion

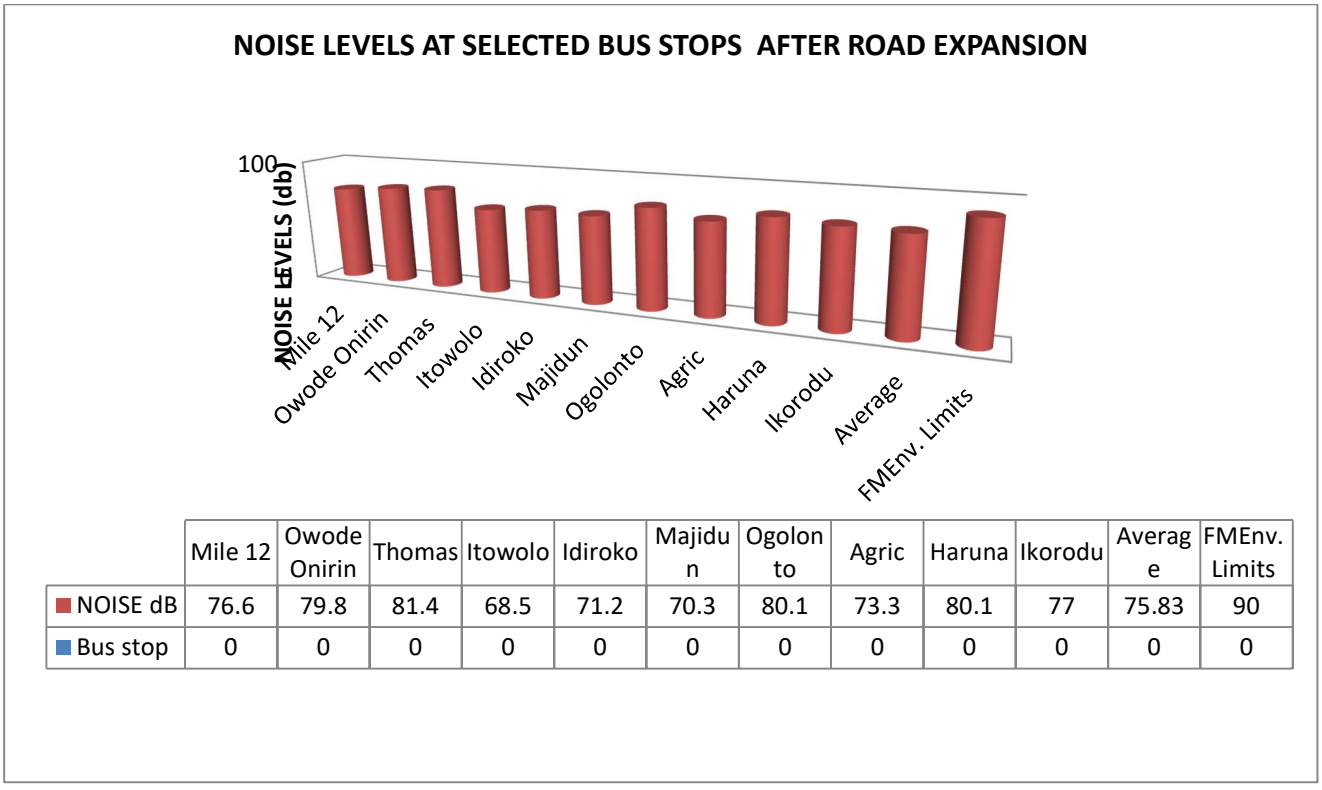
2.6.2 Assessment of Noise Quality

The Federal ministry of environment standard for Noise is 90dB in the study area. It appears that noise test at all the selected locations are below 90dB both before and after the expansion exercise. This implies that the noise being generated during and after the expansion is insignificantly low in comparison to the Environmental standard.



	Mile 12	Owode Onirin	Thomas	Itowolo	Idiroko	Majidun	Ogolonto	Agric	Haruna	Ikorodu	Average	FMEnv. Limits
Bus stop	0	0	0	0	0	0	0	0	0	0	0	0
NOISE dB	77.5	76.4	82.2	81.5	76.4	85.2	79.9	88.5	87.2	77.8	81.26	90

Fig 2.5: Showing Noise Levels at selected sample locations before road expansion



	Mile 12	Owode Onirin	Thomas	Itowolo	Idiroko	Majidun	Ogolonto	Agric	Haruna	Ikorodu	Average	FMEnv. Limits
NOISE dB	76.6	79.8	81.4	68.5	71.2	70.3	80.1	73.3	80.1	77	75.83	90
Bus stop	0	0	0	0	0	0	0	0	0	0	0	0

Fig 2.6: Showing Noise Levels at selected sample locations after road expansion

3.0 Discussion of Results

The findings in this study are explained in terms of the impact this expansion exercise might have caused and the enhancement measures put in place.

3.1 Potential Impacts

Clean air is considered to be a basic requirement of human health and well-being. However, air pollution continues to pose a significant threat to health worldwide. According to a WHO assessment of the burden of disease due to air pollution, more than 2 million premature deaths each year can be attributed to the effects of urban outdoor air pollution and indoor air pollution (caused by the burning of solid fuels). More than half of this disease burden is borne by the populations of developing countries. (WHO, 2005).

Positive impacts do not require mitigation measures. Negatives impacts require to be mitigated, to reduce their levels of significance. For this reason, the main negative impacts are discussed, with corresponding mitigation measures described under each impact.

3.2 Air Quality and Noise Levels

Air degradation will result from construction related operations and vehicular traffic loadings. Air-borne particulates resulting from soil disturbances during construction activities are expected with major impacts at 6 of the 10 Bus Stops along the corridor. All diesel-powered facilities such as power generators, bull-dozers, trucks and heavy machineries would emit SO_2, CO_2, CO, NO_2 and other hazardous gases. These combustion gases can cause air pollution problems and health related hazards for people in the vicinity. In addition to the vehicular traffic, other heavy duty automobiles will be brought to site for construction works, excavation, sand filling, piling, back-filling and concreting activities. (LAMATA, 2010)

In this study, degradation of air quality occurred mainly due to emission from vehicular traffic and the generation of fugitive dust.

Ambient noise levels may also be elevated by these activities. These will contrive to degrade ambient air conditions in the project area. Similarly, the roaring of cars, trucks and trailers will lead to an elevation of ambient noise levels in the immediate project area. But in the short term,

from the air and noise level data gathered from field, it appears that the air quality and noise levels, both before and after expansions are within Environmental standard.

4.0 Conclusions

Some of these impacts for instance air pollution from vehicle exhausts are beyond the control of the project proponents, since they cannot control the types of vehicles that will ply the roads they build. However, on a state and national level, efforts should be made to regulate the emission limits and compliance of all vehicles that are certified as roadworthy.

The rehabilitation and expansion of the road and anticipated ease of traffic flow will encourage a lot of people to relocate to the project area after completion. As such, it should be expected that the general population of the project area will increase. While, this is not expected to lead to any definite change in sex ratio (assuming that whole families will move, rather than individuals), overall population is expected to increase.

Although no mitigation measure is required for this impact of increasing population, from the viewpoint of the project proponent. However, the state government will need to enact laws that will moderate the rate of growth of new towns and development of new layouts. In addition, the government shall provide additional facilities and infrastructure needed to cope with the increased populations in the project area.

3.0 Recommendations

From the foregoing and the acquired data sets, it is inherent that the long-term socio-economic benefit of the road significantly outweighs the negative environmental and social impacts.

The following general recommendations have been highlighted:

- Traffic calming measures should be introduced where social or cultural gathering places occur in close proximity to the new and existing alignments.
- By reducing our use of energy in our homes and vehicles, it is possible to reduce the air pollution being created. So reducing energy use can lead to better health.

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