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Road Safety Audit of a Typical Multilane Rural Principal Arterial in Nigeria

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ABSTRACT

In Nigeria where this study was carried out, 5,440 persons died while 30,478 persons sustained various degrees of injuries in 9,734 road traffic accidents across highways in 2015. This necessitates taking proactive measures to reduce accidents and the resulting casualties. Road safety audit (RSA) has been found among other measures to be an effective tool for proactively improving the future safety performance of a roadway during the planning and design stages and for identifying safety issues in existing transportation facilities. A road safety audit was carried out on an existing divided multilane rural principal arterial, Ilorin – Ogbomosho, which is a typical expressway in Nigeria. Visual inspection was carried out and measurements were taken. The study showed that the lane width is adequate, however, the access to and egress from the highway is not adequately controlled. The observed average speed of moving vehicles is 99.85 km/hr which is okay for the design speed of 100 km/hr and posted speed of 100 km/hr. The width of the clear zone of the highway on most stretches of the road is less than the minimum required 9 m. Other features noticed that need to be remedied include: improper garage location, potholes, improper median opening, abandonment of accident vehicles on the road, double parking on the roadway among others. It is suggested that Nigerian guidelines and toolkits on RSA be developed and published.

1. INTRODUCTION

The high vehicular population in Nigeria, estimated at over 7.8 million on a road network of 200,183 kilometres coupled with a crippled rail transportation system puts intense traffic pressure on the road which contributes to the high road traffic accidents in the country (FRSC, 2012). In 2015, 5,440 persons died while 30,478 persons sustained various degrees of injuries as a result of road traffic accidents across highways in Nigeria (FRSC, 2015a). WHO (2009) projected that road traffic death will increase by 80% in developing countries by 2020 if adequate measures are not taken. Despite the alarm, action to combat the challenge is

reported as insufficient (WHO, 2015). Road safety audit has been found among other measures to be an effective tool for proactively improving the future safety performance of a roadway during the planning and design stages and for identifying safety issues in existing transportation facilities (FHWA, 2006).

A road safety audit (RSA) is a systematic procedure, which brings traffic safety knowledge into the road planning, design, construction and operations process with the purpose of preventing traffic accidents and minimising its severity if at all it occurs (Al-haji, 2008). Other important benefits of RSA include a reduction in the life-cycle cost of a road, provision of feedback to highway designers that they can apply to other projects as appropriate and ensuring that high quality is maintained throughout a project's lifecycle (NCHRP, 2004). RSA is conducted by an independent and qualified team of road safety specialists and identifies potential road safety problems from the point of view of all road users and results in recommendations or findings that should be considered when a project is reviewed (ADB, 2014). The costs of an RSA can vary greatly depending on the size of the project and the phase in which the audit takes place. RSAs applied early in the planning and preliminary design of roads offer the greatest opportunity for beneficial influence. As a design progresses into detailed design and construction, changes that may improve safety performance typically become more difficult, costly, and time-consuming to implement (FHWA, 2006). Benefits to cost ratio of undertaking RSA can be around 20:1 and the measures that are recommended can have a benefit to cost ratio of up to 250:1 (WHO, 2015). Globally, countries where RSA has been practised, have recorded success stories indicating that road safety audit is a very essential and indispensable tool to be employed in order to reduce cost and number of traffic accidents (NCHRP, 2004; FHWA, 2009; SWOV, 2012).

In order to save lives and for the reason of other benefits resulting from RSA, it is very important to encourage and carry out road safety audit periodically on Nigerian roads. The aim of this study, therefore, is to identify the existing safety deficiencies in the design, layout, road furniture and usage of Ilorin – Ogbomosho expressway in Nigeria that are not consistent with the road's function and proffer remedial measures.

2. METHODOLOGY

2.1. The Study Area

The road is a 2-lane dual-carriageway of 53 km which connects two Nigerian cities with high populations namely Ilorin and Ogbomosho, and some other smaller towns and villages located along the road. The multilane rural arterial links the South-west and Northern Nigeria together and functions as an expressway. The Road Safety Audit was conducted on the entire length of the expressway and audited for both traffic directions. The audit was conducted while driving and walking along the subject road and measurements were taken with a tape. The weather at the times of visit was good.

2.2. List of Hazards

The hazards on the roadway were observed manually by visual inspection and recorded against the checklist form. Photographs and video recordings were also taken and carried out respectively. The hazards looked for which were classified into two different groups are: 1. road design hazards which include missing shoulder, improper junction design, improper connection to shop, petrol station, commercial activities, improper median opening, improper signage, too small radius of horizontal curve etc and 2. roadside area hazards which include dangerous fixed objects on the roadway, dangerous fixed object on the roadside, median, road island, road edge deterioration, big tree close to the road, missing sign among others (FHWA, 2006).

2.3. Volume Data

Traffic volume study was conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help to identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, and document traffic volume trends (ETSC, 1997). The volume data in the study is secondary data obtained from the Federal Road Safety Corps of Nigeria.

2.4. Speed Data

Speed data is an essential data needed for road safety audit on an existing road. Design speed is a selected speed used to determine the various geometric design features of the roadway. The speed data in the study was determined manually by observing the time taken by twenty randomly selected vehicles to cover a 100-m long road segment.

2.5. Accident Data

An accident database is needed for accurate assessment of the road safety situation. In order to be useful, the record needs to cover data on deaths and casualties and the circumstances of the accidents. Accident data used in the study were secondary data obtained from the Nigerian Police Force. The data collected was from 2009 – 2015.

2.6. Determination of Clear Zone Area

According to AASHTO (2011), the width of the clear zone is determined by evaluating the annual average daily traffic (AADT), the design speed, and cut or fill slope section of roadside slope. Based on these parameters, the required widths of safety zone were obtained in Table 1.

Table 1: Recommended clear zone width (Department of Main Roads, Traffic & Road Use Management Division, 2001)

Design Speed	Design Year of AADT	Cuts or Fills (Negative Shelf)		Cuts or Fills (Positive Shelf)	
		1.6 or flatter	1.4	1.4	1.6 or flatter
60 km/hr or less	Under 750	2.0	2.0	2.0	2.0
	750 - 1500	3.0	3.5	3.0	3.0
	1500 - 6000	3.5	4.5	3.5	3.5
	Over 6000	4.5	5.0	4.5	4.5
70-80 km/hr	Under 750	3.0	3.5	2.5	3.0
	750 - 1500	4.5	5.0	3.5	4.5
	1500 - 6000	5.0	6.0	4.5	5.0
	Over 6000	6.0	7.5	5.5	6.0
90 km/hr	Under 750	3.5	4.5	3.0	3.0
	750 - 1500	5.0	6.0	4.5	5.0
	1500 - 6000	6.0	7.5	5.0	6.0
	Over 6000	6.5	8.0	6.0	6.5
100km/hr	Under 750	5.0	6.0	3.5	4.5
	750 - 1500	6.0	8.0	5.0	6.0
	1500 - 6000	8.0	9.0	5.5	7.5
	Over 6000	9.0	9.0	7.5	8.0
110 km/hr	Under 750	5.5	6.0	4.5	4.5
	750 - 1500	7.5	8.5	5.5	6.0
	1500 - 6000	8.5	9.0	6.5	8.0
	Over 6000	9.0	9.0	8.0	8.5

2.7. Safety Auditing Reporting

After identifying all potential safety issues, the audit report was prepared. The auditing report contains a list of concerns about road safety matters and recommendations on how these identified potential safety problems in the existing road will be addressed.

3. RESULTS AND DISCUSSION

3.1. Volume Data

The data obtained from FRSC shown in Table 2 is a 12-hour count and was used to compute the Annual Average Daily Traffic for the road using two conversion factors namely: E-factor used to transform 12-hour flows into 16-hour flows and M-factor utilized to transform 16-hour flow into AADT values as suggested by Department of Transport (1996). The computed AADT from the data was 9,600 veh/day. The value was used with the vehicle speed obtained in Section 3.2 to determine the required safety zone.

Table 2: Summary of the total vehicle (to and fro) on daily basis (FRSC, 2015b)

Date	Ilorin-Ogbomosho	Ogbomosho-Ilorin	Total
14/04/15	2798	2906	5,704
15/04/15	4093	3926	8,019
16/04/15	10526	6277	16,803
17/04/15	4672	2372	7,044
18/04/15	2152	2596	4,748
19/04/15	3425	3742	7,167
20/04/15	4184	4090	8,274
Total	31,850	25,909	57,759

3.2. Speed Data

The speed obtained for the twenty sampled vehicles is given in Table 3. The posted speed on the roadway was 100 km/hr while the average speed obtained from the speed survey was 99.85km/hr. Observed operating speed compared favourably with the posted and design speed of 100 km/hr (Federal Ministry of Works, 2013).

Table 3: Speed data collected at km 27+300 along Ogbomosho – Ilorin route

S/N	Time (s)	Speed (m/s)	Speed (km/h)	S/N	Time (s)	Speed (m/s)	Speed (km/h)
1	5.10	19.61	70.59	11	4.24	23.58	84.89
2	6.00	16.66	59.98	12	5.72	17.48	62.93
3	6.10	16.39	59.04	13	5.04	19.84	71.42
4	4.80	20.83	74.99	14	3.12	32.05	115.38
5	3.87	25.84	93.02	15	4.02	24.88	89.57
6	2.50	40.00	144.00	16	2.42	41.32	148.75
7	3.00	33.33	119.99	17	2.87	34.84	125.84
8	5.05	19.80	71.28	18	3.20	31.25	112.50
9	3.25	30.77	110.77	19	2.80	35.71	128.56
10	2.48	40.32	145.15	20	3.32	30.12	108.43

3.3. Safety Zone

The width of the clear zone was evaluated based on the calculated AADT of 9,600 vehicles/day. Considering the average speed of the study route of approximately 100 km/hr, the width of the clear zone was found to be 9 metres when checked in Table 1. The safety zone of the study route, however, ranged from zero to ten metres.

3.4. Accident Data

Accident data is very useful for designing appropriate countermeasures, producing plans, monitoring effectiveness and carrying out research. Accident data used in the study was for 2009 -2015 and shown in Table 4. From Table 4 it can be concluded that there has been no significant decrease in the number of accidents and casualties recorded on the road since put into operation.

Table 4: Summary of traffic accident data on study route (Kwara State Police Command, Otte Division, 2016)

Year	Total cases reported	Persons killed	Persons injured
2009	9	11	22
2010	10	6	17
2011	12	8	11
2012	10	5	13
2013	8	7	15
2014	9	8	20
2015	7	9	10

3.5. Identified Road Users

The identified users of the road are the general public, commercial transport operators, tourism operators, school bus operators, pedestrians, bicyclists, motorcyclists, agricultural machinery operators, emergency service vehicle, road maintenance vehicles and heavy machinery operators.

3.6. Surroundings/Land Use

There is a roundabout at km 0+000 (Geri-Alimi), with an unauthorised garage/motor park (i.e. Ibadan and Ogbomosho Motor Garage) at the roadside. The Ilorin international airport is located at km 3+900, while the Ilorin aviation school is at km 5+100. At km 9+000 is Eiyekorin town with another big roundabout of 37-metre diameter. Adjoining land uses include commercial shops and premises, Hotels, Petrol station, Schools, Rural residential development. There are 17 villages and towns along the route which names and their locations are given in Table 5.

3.7. Comparison of Geometric Layout with AASHTO (2011) Standard

In order to improve safety at any defect location, the features of the road were summarised and compared with the AASHTO Highway Design Manual (Multilane Rural Arterial Highway) as shown in Table 6. The expressway was classified as a multilane rural arterial highway (by referring to AASHTO (2011) standard) based on the roadway features observed. It was constructed in the year 2009 and is a four-lane divided highway. The road is a trunk "A" classification that forms the skeleton of the national road grid. It cuts across two states' boundaries in the country. The road is 53 kilometres long with a carriageway width of 7.3 metres and varying shoulder width from 1.7 to 2.8 metres. The starting point of the study is at Geri-Alimi Roundabout in Ilorin and it's 42 metres in diameter. The width of the starting median at the roundabout is 19.8 metres before it later reduces to 1.95 metres. The concrete median is 0.9 metres high and has a top width

of 0.2 metres. The road ends at a T-junction in Ogbomosho, which connects to a principal arterial in the town.

Table 5: Towns/villages located along Ilorin – Ogbomosho expressway

S/N	Direction	Town/village name	Chainage (km)	S/N	Direction	Town/village name	Chainage (km)
1	Ilorin - Ogbomosho	Geri-Alimi	0+000	10	Ogbomosho – Ilorin	Ojutaye	27+800
2	Ilorin - Ogbomosho	Laho	1+300	11	Ogbomosho – Ilorin	Gbede	30+200
3	Ilorin - Ogbomosho	Egbejila	4+500	12	Ogbomosho – Ilorin	Gambari	32+400
4	Ilorin - Ogbomosho	Budo Nuhu	5+200	13	Ogbomosho – Ilorin	Abule-Igbon	34+300
5	Ilorin - Ogbomosho	Eiyekorin	9+000	14	Ogbomosho – Ilorin	Egbeda	37+700
6	Ilorin - Ogbomosho	Lasoju	12+100	15	Ogbomosho – Ilorin	Ladokun	41+000
7	Ilorin - Ogbomosho	Adabata	15+900	16	Ogbomosho – Ilorin	Aroje	43+100
8	Ilorin - Ogbomosho	Gbagba	21+500	17	Ogbomosho – Ilorin	Ogbomosho	50+200
9	Ilorin - Ogbomosho	Otte	25+100				

Table 6: Comparison with AASHTO (2011) Specifications (multilane rural principal arterial)

S/N	Roadway element	AASHTO standard values (AASHTO, 2011)	Observed values	Remarks
1	Design speed	60-120 km/hr Depending on the terrain	60 – 140 km/hr	Adequate
2	Number of lanes	Four or more	Four lanes	Adequate
3	Travel lane width	3.6 m minimum	3.65m	Adequate
4	Right shoulder width	3.0 m	1.7 – 2.8m	Fairly ok
5	Left shoulder width	3.0 m	0.0 – 2.8	Fairly ok
6	Turn lane width	3.6 m	3.0 – 3.8m	Adequate
7	Median width including left shoulders	Wide median 7.5m minimum	11.0 - 12.1	Adequate
8	Roadside clear zone	9 m	0.0 – 10m	Fairly ok
9	Bridge width	At least full approach travelled way width or plus 1.0 m clearance on each side	2/3 of travelled way width	Not adequate
10	Control of access	Partial/by regulation	Uncontrolled access	Not okay
11	Pedestrians crossing	Controlled	Uncontrolled	Not okay

3.8. Road Safety Audit Checklist

Table 7 shows the safety audit checklist on the route, based on the field observations recorded during the site visits in both directions.

Table 7: The safety audit checklist (both directions)

S/N	Types of hazards	Comments	Image no	Chainage (km)
1	Nil	Start station of the audit route	Plate 1	0+000
2	Trees close to the road	Increases roadside accidents	Plate 2	16+300
3	Improper garage location	Decreases roadway capacity	Plate 3	0+300
4	Missing safety zone	Dangerous to road users	Plate 4	13+100
5	Improper placement of electric pole	Increases accidents potential	Plate 5	11+700
6	Trailer double parking	Restricted lateral sight distance and roadway capacity	Plate 6	34+300
7	Improper connection to petrol station	Increases accidents potential	Plate 7	35+900
8	Abandoned accident vehicles	Increases roadside accidents	Plate 8	30+200
9	Improper signage and marking	Increases accidents on the road	Plate 9	8+800
10	Signage covered by vegetation	Dangerous to road users	Plate 10	49+300
11	Pavement defect (Slippage, Cracks)	Increases accidents on the road	Plate 11	12+100
12	Pavement defect (Asphalt removed)	Increases accidents potential	Plate 12	50+100
13	Pavement defect (Potholes)	Increases accidents potential	Plate 13	17+500
14	Wearing of the shoulder	Dangerous to road users	Plate 14	5+200
15	Obliterated kilometre post	Gives lack of distance information about route	Plate 15	1+300
16	Lack of information sign when approaching bridges	Causes confusions which can lead to accident	Plate 16	37+700
17	Improper median opening	Turning vehicles pose as dangers to other vehicles	Plate 17	25+100
18	Dumping of garbage's within safety zone	Very dangerous to human health	Plate 18	4+500
19	Road edge break	Decreases roadway capacity	Plate 19	8+100
20	No pedestrian footbridge or signage	Risky for pedestrians	Plate 20	Entire stretch
21	Building within safety zone	Dangerous to the vehicle and building occupants	Plate 21	Both sides

3.9. Typical Hazards and Proposed Countermeasures

3.9.1. Trees within the safety zone

The start station of the road is seen in Plate 1. There are a lot of trees of varying sizes and types on both sides of the roadside within the safety zone. Some of the trees have diameters greater than one metre. During the field survey, trees which can be considered as fixed objects within the safety zone and which pose as high potential safety risks were recorded as shown in Plate 2. The trees are located at km 16+300, km 31+600 (Ilorin – Ogbomosho direction) and km 22+300 (Ogbomosho – Ilorin direction).

Remedy:

In order to enhance lateral sight distance, the trees must be removed from the safety zone. However, the potential benefits of removing such obstacles should be weighed against the adverse environmental and aesthetic effects of their removal. Therefore, trees should be removed only when considered essential for safety and alternatively, trees which cannot be removed should be protected by guardrails.

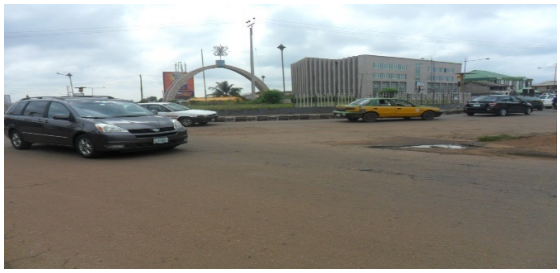

Plate 1: Start station of the audit route at km 0+000 (Geri-Alimi Roundabout)

Plate 2: Trees within the safety zone at km 16+300

3.9.2. Improper garage location

There is the improper location of an unauthorized motor park/garage on the shoulders of the audited route at km 0+300 to km 0+650 as shown in Plate 3. The garage decreased the capacity of the roadway, which is very dangerous for road users and can cause accidents.

Remedy:
The appropriate authority should relocate the garage from the roadside to a better place, not near the road.

Plate 3: Improper garage location at km 0+300 to 0+650

3.9.3. Missing safety zone

A safety zone is an unobstructed, traversable roadside area that allows a driver to stop safely, or regain control of a vehicle that has veered off the roadway. By creating clear zones, roadway agencies can increase the likelihood that a roadway departure results in a safe recovery rather than a crash, and mitigate the severity of crashes that do occur. The width of the safety zone in some segments/areas was zero, for example, the safety zone of the right side from km 0+000 to km 50+200 was inadequate in the Ilorin – Ogbomosho direction as shown in Plate 4. The safety zone was also zero in the Ogbomosho – Ilorin direction. There are electricity poles, telephone poles, billboards, houses and shops on both sides within the safety zone area. The most frequent are electricity poles located at 50-metre intervals as shown in Plate 5. These locations were assessed as potentially dangerous points at which severity of crashes will increase if there is for example loss of control by drivers.

Remedy:
- Removal or relocation of objects, utility poles and other features from the safety zone area, or by burying the cables underground, this will be a long-term project with high cost implications.
- Installing reflectors on objects such as poles. that can be seen by drivers from a far distance. This solution has a low-cost implication and can be implemented within a short period.

- Installing guardrail or crash cushion for hazardous utility poles which has a low/mid cost implication for implementation near turns.

- Following the AASTHO standard by dedicating about 9 metres distance width for safety zone area.

Plate 4: Missing safety zone with grass at shoulder edge at km 13+100

Plate 5: Utility poles within safety zone at km 11+700

3.9.4. Double parking on the roadway

Trailers double parked on both sides of the road at km 34+300, Abule – Igbon town and have indeed turned the shoulders on both directions of the road to parks as shown in Plate 6. This is very dangerous and is an abuse of the road. The trailer drivers park recklessly without road/traffic management agency personnel to apprehend or correct them. Another dangerous aspect in this area is that the trailer drivers enter the carriageway from their parked locations anytime they want, without considering oncoming vehicles. Prolonged parking of heavy axle-load also weakens the pavement and shoulders.

Remedy:
'No parking' order should be enforced along the entire stretch of the road except in the case of emergency.

Plate 6: Double parking on the roadway at km 34+300

Plate 7: Improper access management at a filling at km 35+900

3.9.5. Improper access management

There are many petrol filling stations on both sides of the route, and almost all the filling stations were observed to be improperly designed to access the expressway. An example is shown in Plate 7. There is a particular filling station at km 35+900 between Abule – Igbon and Egbeda, where the entrance and exit of the filling station are within 4 metres of the road. Some drivers exiting from the filling stations may not clearly see oncoming high-speed vehicles which can result in a vehicle collision. Moreover, there were

grasses growing around the filling station which could also obstruct the view of drivers entering or exiting the petrol station.

Remedy:
Driveways to the entrances of the petrol filling stations along the study route should be re-designed to conform with specifications of the Federal Ministry of Works (2013) with appropriate road signs rightly placed to eliminate hazard risks. Grasses in petrol stations' premises resulting in reduced sight distances should also be removed.

3.9.6. Abandoned accident vehicles

Accident vehicles were left at the accident scenes or on the shoulders of both sides of studied route uncatered for, which become safety risks. Abandoned accident vehicles were noticed at km 5+200, km 30+200 and km 43+100 (Ilorin – Ogbomosho direction) and also at km 17+800 (Ogbomosho – Ilorin direction). An example of such abandoned vehicles is shown in Plate 8.

Remedy:

There should be an arrangement by supervision road agency for quick removal of broken down and accident vehicles by stationing towing vehicles at strategic locations along the road. Drivers should also be enforced to use C-caution sign anytime vehicles break down on the road in other to alert other road users.

Plate 8: Abandoned accident vehicle at km 30+200

3.9.7. Improper signing and marking

Most of the information signs were inappropriately located. At km 8+800 (Eiyekorin) when approaching the roundabout as shown in Plate 9 and likewise when approaching the T- junction in Ogbomosho, sighting of placed road signs is obscured by poles, billboards and vegetation that obstruct their clear view and their placements are too close to the intersections, which does not permit drivers to be alerted early before reaching the intersection. The road signage at Ogbomosho T – junction is overgrown with vegetation as evidenced in Plate 10. It was also observed that all the markings on both sides of the route were completely worn out to the extent that they are hardly visible. As a result of these, drivers are not well guided on the lanes which might be a contributory factor to accidents along the route.

Remedy:
In order to ensure proper signage and thereby reduce the confusions on the route the following improvements or countermeasures can be considered:

- Worn out signs should be replaced with new ones.

- Signage should be properly located and installed at required sections of the route (e.g. approaching bridges, intersections, dangerous curves, work zones, schools etc).
- There should be very visible road markings where necessary, such as Left-turn, Right-turn, U-turn, pedestrian crossing signs etc.
- Existing markings/road signs improperly located and which can cause confusion on the route should be relocated.

Plate 9: Improper signage at km 8+800

Plate 10: Signage almost covered by vegetation at km 49+300

3.9.8. Pavement defects

The pavement condition of the road is good. However, there were some areas on both carriageways that needed repairs. Defects in these areas include slippage cracks, potholes, rut and edge breaks as shown in Plates 11 to 14. A very bad portion of the road exists at km 50+000 when approaching the T-junction in Ogbomosho where the asphaltic pavement has removed completely over a distance of 80m which led to erosion and very undulating roadway. There is a high potential for accident occurrence in this particular area.

Plate 11: Pavement defect (slippage cracks) at km 12+100

Plate 12: Pavement defect (asphalt removed) at km 50+100 (both sides of the road)

Plate 13: Pavement defect (pothole) at km 17+500

Plate 12: Wearing of the shoulder at km 5+200

Remedy:
These defects can be remedied by adopting the following countermeasures:

- The missing shoulder should be reconstructed and paved.
- Filling the potholes with appropriate materials where necessary should be done.
- The appropriate authorities should check and maintain the route and quickly fix any defects on the route for better and safer movements.

The other defects identified along the study route were (Plates 15 – 21):

- worn out kilometre posts
- no signage when approaching the bridge
- improper median opening
- dumping of garbage on roadsides
- no pedestrian crossing signage or footbridge on the road throughout the entire road length


Plate 13: Obliterated kilometre post at km 1+300


Plate 14: No signage on either side when approaching the bridge at km 37+700

Plate 15: Improper median opening at km 25+100 Otte (both sides of the road)


Plate 16: Dumping of garbage's at km 4+500


Plate 17: Road edge breaks at km 8+100

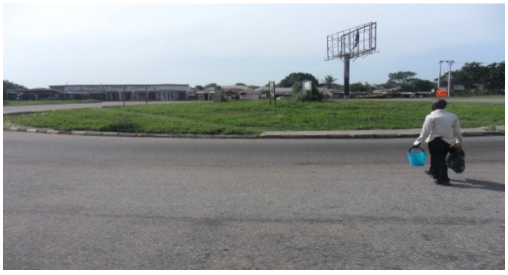
Plate 18: No pedestrian crossing signage or footbridge throughout the road length

Plate 19: Buildings on the safety zone on both side

4. CONCLUSION

In the study, the road safety audit on an existing road, Ilorin – Ogbomosho Expressway was carried out. The following conclusions were drawn from the study:

1. The studied road is relatively new in operation but has a lot of defects on it such as improper garage location, potholes, improper median opening, double parking on the roadway, missing safety zone, poor or inadequate signs etc.
2. The guardrail, median barriers, information signs, sign size/letter size, guideposts and guardrail reflectors, bridge markers, posted speed limits etc provided at the start of operation of the roadway have either been vandalized or left unmaintained to degenerate to such a stage that renders them non-functional or ineffective for the purposes for which they were intended.
3. Preventive maintenance is hardly carried out on the studied route. Rather, corrective maintenance whereby the operations will gulp huge sums of money is noticeable. For instance, potholes, weak bridges, missing shoulder, broken guard railings/barriers, lighting, sharp curvature on roads, blocked drains, flooded roads, skidding and undulating road surfaces are features on the road indicating inadequate maintenance.
4. It is suggested that Nigerian guidelines and toolkits on RSA be developed and published.

5. CONFLICT OF INTEREST

There is no conflict of interest associated with this work.

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