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# ASSESSMENT OF THE EFFECTS OF GEOMETRIC FEATURES ON THE SAFETY OF ROAD USERS ON ADO-IJAN ROAD IN EKITI STATE, NIGERIA

**[1]Abe Omoloye Elijah and [2]* Akinwamide Oluwayinka Glory**

Department of Civil Engineering, Federal Polytechnic, Ado-Ekiti, Nigeria.

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***Corresponding Author**
**Akinwamide Oluwayinka Glory**
Department of Civil Engineering, Federal Polytechnic, Ado-Ekiti, Nigeria.

## ABSTRACT

This study deals with the assessment of the effects of geometric features on the safety of road users on Ado-Ijan road in Ekiti state, Nigeria. In carrying out this study, field surveys of all the highway geometries on the road were carried out. The results of the survey showed that many of the highway geometric features fell short of standard value. For instance, the median provided up to location 2.0m ranges between 0.80m and 0.82m as against the specification of between 3.0m and 5.0m. The camber is 1in 30 as against standard value of between 1 in 50 and 1.40. Also the shoulders provided along the road is between 1.45m and 1.64m compared to 2.5m minimum standard value. Depth of u-shaped drainage channel, where provided, is also between 0.25m and 0.35m instead of 0.3m to 0.6m standard value. There are no provision for footpath, kerb and other highway geometry facilities that will enhance safety of road users on the highway. Stopping sight distance ranges between 36m and 80m. The camber, vertical curves and horizontal curves are not also adequate. Therefore, it was discovered that non-conformity to specifications of these highway geometric features has contributed immensely to the spate of accidents on the road.

**KEYWORDS:** Assessment, geometric, safety, road-users, Ekiti State, Nigeria.

## 1.0 INTRODUCTION

Geometric design is the most important aspect of highway design which is concerned with the visible dimensions of a roadway. It includes the design elements of horizontal and vertical alignment, sight distance, cross-section components, lateral and vertical clearances, intersection etc (Kadiyali, 2012).

The safe, efficient and economic operation of a highway is governed to a large extent by the care with which the geometric design has been worked out.

Safety or lack of it is an immediate corollary of the various design features of the roadway (Babkov, 2007). In other words, safety is an important parameter to be built into the design elements with a view to enabling all road users (motor vehicles, animal drawn vehicles, cyclists and pedestrians) to use the facility with minimum cost and comfort (WHO, 2006).

Whenever a new road is constructed or existing roads are taken up for improvement the features of the highway must be designed with a clear objective of enhancing safety by paying attention to the design speed, stopping sight distance, overtaking sight distance, horizontal curves, adequate super elevation, carriage-way with shoulders, vertical alignments among others.

Adequate geometric design in planning a highway facility ensures that the facility will not become obsolete in the foreseeable future. Faulty geometrics are costly, if not impossible to rectify at a later date and so, due consideration should be given to geometric design at the initial stage itself (Kadyali, 2012).

Therefore, this research aims at assessing the effects of some of these geometric features on road users safety.

## 2.0 MATERIALS AND METHODS

Measurements of some geometric design features such as lane width, median, shoulder (at both sides of the road), depth of drains were made using measuring tapes (Kenneth, 1998). Speeds, stopping sight distance, super-elevation were also observed, determined and compared with the values of the India Road Congress (IRC) and American Association of State Highways and Transportation Officials (AASHTO) as shown on table 1 below:

**Table 1: Recommended values of the Indian Road Congress (IRC)/American Association of State Highway and Transportation Officials (AASHTO).**

| | Geometric Features | Recommended Values |
|---|---|---|
| (1) | 2-Lane Width (m) | 5.50-7.00 |
| (2) | Median (m) | 3.00 – 5.00 |
| (3) | Shoulder (m) | 2.50 |
| 4. | Camber (%) | 1:50 – 1:40 (2.0- 2.5)% |
| (5) | Safe Stopping Distance (m) | 45 for speed of 40km/hr<br>80 for speed of 60km/hr<br>120 for speed of 80km/hr |
| (6) | Depth of drain (m) | 0.3 – 0.6 below shoulder level. |
| (7) | Super-elevation (m) | 0.07 – 1.10 |
| (8) | Foot Path (m) | 2.00 |
| (9) | Height of kerb(cm) | 15-25 |

## 3.0 RESULTS AND DISCUSSION

Table 2 below shows the summary of the survey results of the road covering a total distance of 15km.

**Table 2: Values of geometric design features on Ado-Ijan Road.**

| Distance/ Location (Km) | Lane width (m) | Median (m) | Shoulder (m) | | Camber (%) | Stopping Sight Dist.(m) | Speed Km/hr | Depth of Road Side Ditch (m) | | Super-elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Left | Right | | | | Left | Right | |
| 0.0 | 6.80 | 0.82 | 1.61 | 1.64 | 1.30 | 36.00 | 40 | 0.35 | 0.35 | NA |
| 2.0 | 6.80 | 0.80 | 1.60 | 1.64 | 1.30 | 36.00 | 40 | 0.30 | 0.30 | NA |
| 4.0 | 6.80 | NA | 1.55 | 1.55 | 1.30 | 36.00 | 40 | 0.30 | 0.35 | NA |
| 6.0 | 5.00 | NA | 1.45 | 1.45 | 1.30 | 70.00 | 60 | 0.28 | 0.28 | NA |
| 8.0 | 5.00 | NA | 1.50 | 1.50 | 1.30 | 60.00 | 80 | NA | NA | NA |
| 10.0 | 5.00 | NA | 1.50 | 1.50 | 1.30 | 60.00 | 80 | NA | NA | 0.08 |
| 12.0 | 5.00 | NA | 1.50 | 1.50 | 1.30 | 80.00 | 80 | NA | NA | NA |
| 14.0 | 5.00 | NA | 1.50 | 1.50 | 1.30 | 80.00 | 80 | 0.25 | 0.25 | NA |
| 15.0 | 5.00 | NA | 1.50 | 1.50 | 1.30 | 80.00 | 80 | 0.25 | 0.25 | NA |

*** NA:** (Not Applicable).

### Lane width

The results show that the lane width ranges between 5.0m and 7.0m. this was found to be adequate between locations 0.0km and 4.0km which is still within Ado-Ekiti metropolis.

### Median

As shown in Table 2, median is provided up to location 2.0km and the values are between 0.80m and 0.82m. this is however, not adequate if compared with the standard of between 3.00m and 5.00m.

**Shoulder**

Shoulders are provided at both sides of the road. The width ranges between 1.45m and 1.50m as against the minimum value of 2.5m as recommended by IRS.

**Camber**

Table 2 also shows the value of camber provided. The value is 1.30% which is less than the recommended value of between 2.0% - 2.5%.

**Sight Distance**

The sight distance and operating speed measured on the road are as shown in the table. Design speed of 100km/hr could not be maintained on the road because of the inadequacies of various geometric features provided, hence, values of sight distances obtained are not appropriate for the design speed.

**Drainage (Roadside ditch)**

U-shaped ditches were provided on both sides of the road at location (0.0 and 6.0)km with depth ranging between 0.28m and 0.35m and also at location (14.00 and 15.00)km with depth of 0.25m as shown in Table 1.

To fulfill the requirement of the roadside ditch to drain the base course of the road pavement, the bottom of the ditch has to be taken, at least, to a depth 0.3m to 0.6m below the shoulder level (AASHTO, 1986).

**Superelevation**

Value of superelevation provided on the curve at location 12.00km is 0.08. This is, however, adequate.

## 4.0 CONCLUSION

The results of this study showed that all the geometric design features provided on the road are not adequate except the lane width at the beginning of the road and the super-elevation. Foot paths, kerbs are not also provided. It can therefore be inferred that safety of users on this road can not be guaranteed for all these inadequacies.

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