



A STUDY OF ACTUAL AND POSTED SPEED ON SOME NIGERIAN ROADS

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Abstract

There is a massive problem of overspeeding on Nigerian highways. This problem is exacerbated by the absence of posted speed signs which though installed after reconstruction/rehabilitation are usually vandalised and not replaced. Where posted speed limits exist, they are largely observed in the breach as large pluralities of motorists exceed these posted speed limits. Using speed data from automatic traffic classifiers installed at locations on road sections on the federal highway network, this study is aimed at assessing the extent of the disparity between posted and actual speed with a view to identify areas of prevalent overspeeding, evaluate the extent of the problem, determine the trend of the problem, and better target enforcement activities on areas of high rates of overspeeding. The results from the study show that there is a prevalence of overspeeding in the highway sections studied with the maximum speed in all Sections in the range of 150 to 160 km/h and up to 20 percent of vehicles traveling at speeds above 100 km/h.

Keywords: posted speed limits, actual speed, 85th percentile speed, Nigeria roads, overspeeding/speeding

1 Introduction

Overspeeding, traveling above the posted speed limit, is the predominant human causative factor of road traffic crashes [1]. Overspeeding in Nigeria is so prevalent that it is considered in some quarters to have attained epidemic proportions. Overspeeding and all speed related factors accounted for about 40 to 50 % and 60 to 70 % of road traffic crashes in Nigeria in the years 2017 to 2019 [2, 3, 4]. However, extent of the problem, having not been studied, is not clearly understood

The relationship between crash severity and speed, that is, crash severity increases geometrically as speed increases is well established by the laws of physics [1, 5, 6, 7]. The impact of speed on crash occurrence is mired in controversy. This is primarily due to the fact that the precise relationship between speed and crash occurrence can be obscured by the variety of road design and operating characteristics [5, 7, 8]. While this relationship has been a topic of numerous studies that produced conflicting results [7, 9, 10], a study on the topic [8] which is considered to be the most statistically robust [7] indicates definitely that all other factors being equal, increased speed increase crash occurrence.

Generally, drivers travel at speeds they think is reasonable and safe for a given condition [6, 8]. To forestall a free-for-all where each driver chooses their own speeds and taking cognizance that some drivers will not be reasonable in their choice, speed limits are posted on highways to ensure they are safe to all drivers. Posted speed limits are typically determined using the following factors [6, 7, 10, 11]: 85th percentile speed determination, highway design,

accident history, traffic volume, road type and surface. Drivers expect posted speeds to be reasonable, unreasonable posted speeds get little or no consideration from drivers.

Given the poor condition of Nigerian highways, the near total absence of posted signs in all but newly constructed or rehabilitated highways, and the lack of speed enforcement activities (electronic speed enforcement is hardly utilized), drivers are left to their own devices regarding speed. The combination of these three factors has led to the current high rates of overspeeding that is considered to have reached epidemic proportions in some quarters. It also makes obvious the need to deploy the full gamut of safety engineering measures, particularly speed management measures to forestall the attendant effect of road traffic crashes which result in loss of lives and loss to the economy.

This paper reports on a study that generally explored the issue of actual speeds on the Federal Highways in Nigeria exceeding the posted speed limits. The study primarily aimed at assessing the extent of the disparity between posted and actual speed with a view to evaluate the extent of the problem, identify areas of prevalent overspeeding, determine the trend of the problem, and better target enforcement activities on areas of high rates of overspeeding.

2 Methodology

2.1 Data

Data for this study were collected with the aid of pneumatic tube-type automatic traffic classifiers (ATC) installed at a number of stations in each road section during 7-day traffic studies programs on the following five road sections in the Federal Highway network rehabilitated/reconstructed under the Federal Roads Development Project and the Nigeria-Cameroon Multinational Highway and Transport Facilitation Programme. The details of the road sections and the number of data collection stations are shown in Table 1.

The ATCs were installed at locations within road segments where: a) Most traffic travel at constant speed across the tubes (avoiding sites where vehicles are accelerating or decelerating due to bends, steep inclines, traffic signals, or intersections), b) Traffic cross perpendicular to the tubes (avoiding locations will stop over the tubes or turn across the tubes), and c) The posted speed limit is 100 kilometers per hour (km/h), which is the maximum posted speed on Nigerian roads. pneumatic tube-type ATCs have been used by other investigators [7, 12] to study the speed of vehicles on highways.

Table 1 Details of road sections

S/N	Highway Section	Route No.	Length [km]	No. of data stations
1	Enugu-Abakaliki	A 343	77	3
2	Abakaliki-Mbok	A 343	84	4
3	Mbok-Ikom	A 4	52	3
4	Ikom-Mfum	A 4.2	22	2
5	Akure-Ilesha	A 122	76	4

2.2 Data analysis

Binned data (1-hour intervals) was primarily used for the data analyses. Binned data have been used in speed studies by other investigators [10]. The equipment used for data collection does not provide individual raw speed data. Data from the collection stations in each highway section were combined and analysed. Actual speeds were compared to the posted limits. The statistical parameters of the actual speed data, including count, minimum, maxi-

imum, mean, median, variance, 85th percentile speed, and 95th percentile speed, were determined and used for the comparison with the posted speed limit. Also determined was the number/percentage of vehicles with speed exceeding 100 km/h. The 85th percentile speeds for the respective sections for each data year determined were used to assess the difference between the 85th percentile speed and the posted limits (100 km/h).

3 Results and discussion

The summary of the results of the analyses carried out on the actual speed data is presented in Table 2. Table 2 shows the enormity of the overspeeding problem. Generally, the 85th percentile speed for all Highway Sections investigated except the Enugu-Abakaliki Section was below the posted speed limit of 100 km/h. The 85th percentile speed is usually adopted by most jurisdictions in the determination of posted speeds [7, 12]. The adoption of the concept of the 85th percentile speed is based on the theory that the vast majority of vehicle operators have the following characteristics [12, 13]: they are reasonable and prudent, they do not want to be involved in a crash, and they desire to reach their destination in the shortest possible time. In the case where the 85th percentile speed is less than posted speed, like in the Abakaliki-Mbok, Mbok-Ikom, Ikom-Mfum, and Akure-Ilesha sections, the maximum speed is almost double the 85th percentile speed. For the Enugu-Abakaliki Section, it is about 50 % of the 85th percentile speed.

The respective difference between the minimum and maximum speed, mean speed and the 85th percentile speed, and the 85th percentile speed and the maximum speed are quite large. Large range of difference in speed, speed dispersion, is known to contribute to crashes more than speeding on its own [7, 8, 13, 14].

In terms of overspeeding, the percentage above the posted speed of 100 km/h ranged from above 1 % to about 19.7 %. The higher percentages (10-20 %) occur at the Enugu-Abakaliki Section. The Enugu-Abakaliki Section links two state capitals and has large traffic volumes. It should be noted that at the times of this study in 2014, the study highway sections were in very good condition, most of the highway sections had been reconstructed or rehabilitated within the past one to two years. The road sections being in good condition must have contributed to the high rate of overspeeding.

The mid-range percentage of vehicles traveling at speeds above 100 km/h (5-10 %) occur at the Abakaliki-Mbok, (at the early years), Mbok-Ikom, and Akure-Ilesha Sections. In the mid-range excessive speed region, the percentage of vehicles above 100 km/h decreases with increase in years. This is as a result of the deteriorating road condition particularly on the Abakaliki-Mbok Section. It would appear that drivers had chosen the appropriate speed for the road conditions as reported by other researchers that have conducted speed studies [10]. The lower excessive speed range (1-5 %) occurred mainly at the Ikom-Mfum Section. A high proportion of the length of this Section is built-up and it has quite a number of security check points which almost prevents motorists from overspeeding. The Ikom-Mfum Section leads to the Nigeria/Cameroon border at Mfum/Ekok.

Table 2 Summary of results

Year	Min	Max	Mean	Median	VAR	Count	85 %	95 %	>100 km/h
	[km/h]	[km/h]	[km/h]	[km/h]			[km/h]	[km/h]	
Enugu - Abakaliki									
2014	10.0	159.6	76.2	74.9	535.2	123574	101.5	114.1	20711 (16.76%)
2015	10.0	159.1	77.0	76.0	612.0	131056	104.0	117.0	25818 (19.70%)
2016	10.0	160	79.0	78.1	427.2	172205	100.8	113.4	27900 (16.15%)
Abakaliki - Mbok									
2014	10.1	158.6	62.9	60.8	497.6	75429	87.1	102.6	4730 (6.27%)
2015	10.0	122.1	63.5	63.0	391.9	56650	85	99.4	4040 (7.13%)
2016	10.0	155.5	67.3	64.1	512.82	69238	92.9	107.6	6707 (9.69%)
2018	10.0	144.3	57.8	55.4	400.2	66208	79.6	94	1816 (2.74%)
2019	10.0	156.4	55.0	53.6	329.8	76722	73.4	87.5	1216 (1.58%)
Mbok - Ikom									
2014	10.0	158.9	61.2	58.0	467.1	131308	83.5	102.6	7841 (5.97%)
2015	10.0	159.8	59.3	55.8	492.3	127746	82.5	102.2	7450 (5.83%)
2016	10.1	159.2	65.9	61.6	543.75	119476	92.5	108.0	11298 (9.46%)
Ikom - Mfum									
2014	10.1	157.0	58.2	57.6	296.1	49225	74.2	87.8	891 (1.81%)
2015	10.0	158.7	58.5	58.0	323.8	54760	76.0	89.3	1050 (1.92%)
2016	10.1	152.5	59.6	58.3	326.3	75052	77.4	92.2	1812 (2.41%)
2018	10.0	157.1	56.3	55.4	304.8	73823	73.1	86.8	1050 (1.42%)
2019	10.0	155.8	56.4	56.2	282.3	79030	72.7	84.6	856 (1.08%)
Akure - Ilesha									
2016	10.0	159.2	58.8	55.1	415.9	190392	78.1	100.8	10026 (5.27%)

VAR = Variance; km/h = kilometer per hour; Count = Total number of vehicles

4 Conclusions

A speed study was conducted on some five highway sections on the Nigerian Federal Highway network with the aim to identify areas of prevalent over speeding, evaluate the extent of the problem and determine the trend of the problem and better target enforcement of activities on areas of high rates at over speeding. Speed data was collected at a total of 16 stations and analyzed. Based on the analyses conducted in this study, the following conclusions can be reached:

- There is a prevalence of overspeeding (travelling above the posted speed of 100 km/h) in the five highway sections investigated.
- Maximum speeds of 150-160 km/h was registered at all five sections studied.
- The 85th percentile speed for the Enugu-Abakaliki Section was above the posted speed of 100 km/h.
- The 85th percentile speed for the other four Sections Abakaliki-Mbok, Mbok-Ikom, Ikom-Mfum, and Akure-Ilesha were generally below the posted speed of 100 km/h.
- The ranges for the percentage of vehicles travelling at speeds above 100 km/h on the various sections are as follows: Enugu-Abakaliki (16-20 %), Abakaliki-Mbok (1.5-10 %), Mbok-Ikom (5-10 %), Ikom-Mfum (1-2 %), and Akure-Ilesha (5 %).
- There is a tendency for the percentage above 100kmh to reduce with reductions in the quality of the highway with time as seen with highway section where there are data for 5 years.
- There is a need for a larger study, a network-wide study involving highways sections from all parts of the network to have a proper grip on the excessive speed problem/issue.

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