

An Analysis of Vehicle Tyres Usage and Failures on the Highways: Towards Safe Driving in Ondo, Nigeria

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Abstract

The study looks at vehicle tyres usage and associated failures on highway with Ondo, Nigeria being under referenced. The study employed simplified and structured questionnaire to collect information from drivers in the study area. The findings reveal that ninety-four (94) % of respondents had tyres which are fairly used at the point of purchase while fifty-two (52) % of the respondents had tyres that have spent 3 years or more. In addition, only eleven (15.3%) of the respondents had their vehicles fitted with tyres that are not expired. It is also revealed that fifty-two (52) % of them had experienced crash while driving resulting from tyre failure. And almost fifty two (51.9%) of them had insufficient/wrong maintenance as source of their tyre failures. As a result, Federal Road Safety Corps (FRSC) should beam its awareness on tyres by providing training on the various aspects of tyre codes and ratings, necessary to ensure safety on Nigerian roads.

Keywords: FRSC, Tyres usage and failures

1. Introduction

Technically, a tyre is a roughly toroidal¹ shaped composite material, which comprised of compounded rubber mass, textile fabric, steel cords and bead wires, bonded together chemically, covering the circumference of a wheel. From the engineering perspective, it is a mechanical device that determines the smoothness of a ride and therefore determines the control that the driver has on the vehicle in motion. Motoring function, such as steering, cornering, braking, load support and ride comfort are tyre dependent and greatly affect the safety and comfort ability of the vehicle (Balogun, 2006). Tyres are essential and strategic component of the automobiles. They are contact points between the vehicle and the road.

The main purpose of tyre in vehicles are to dampen the oscillation caused by irregularities in road surface, protect the wheel from deterioration and serve as high friction bond between the automobile and the road to improve acceleration and handling (Wikipedia, 2006).

1.1 Material Composition of Vehicle Tyre

Synthetic rubber- Styrene-butadiene copolymer

Natural rubber

Fabric and wire

Carbon black

Other chemical compounds

The materials of modern pneumatic tyres can be divided into two groups, the cords that make up the ply and the elastomer which encases them.

The cord: forms the ply and bead and provide the tensile strength necessary to contain the inflation pressure.

Elastomer: forms the tread and encases the cords, to protect them from abrasion and hold them in place.

1.2 Parts of a Vehicle Tyre

The vehicle tyre components are as follows:

1. The tread
2. Bead
3. Sidewall
4. Shoulder
5. Ply

The tread is the part of the tyre that comes in contact with the road surface and thus responsible for driving force transfer. The tread of a vehicle tyre is disposed towards abrasive effect of the road. The portion that is in contact with road at a given instant in time is the **contact path**. The tread pattern is characterized by the geometrical shape of the grooves, lugs, voids and sipes. Grooves run circumferentially around the tyre, are needed to channel away water. Lugs are that portion of the tread design that contacts the road surface. Voids are spaces between lugs that allow the lugs to flex and evacuate water. Sipes are valleys cut across the tyre, usually perpendicular to the grooves, which allow the water from the grooves to escape to the sides in an effort to

¹ Toroidal (adjective of torus) describes a surface of revolution generated by revolving a circle in three-dimensional space about an axis coplanar with the circle.

prevent hydroplaning.

Bead

The bead is the part of the tyre that contacts the rim on the wheel. The bead seat tightly against the two rims on the wheel to ensure that a tubeless tyre holds air without leakage.

Sidewall

The sidewall is that part of the tyre that bridges between the tread and bead.

Shoulder

The shoulder is that part of the tyre at the edge of the tread as it makes transition to the sidewall.

Ply

Plies are layers of relatively inextensible cord embedded in the rubber to hold its shape by preventing the rubber from stretching in response to internal pressure. The orientation of the plies plays a large role in the performance of the tyre and is one of the main ways that tyres are categorized (Wikipedia, 2015).

Tyre is a degenerating product that needs to be maintained and changed at intervals. Owing to usage and shelf life of tyres, they disintegrate or degrade. The management of tyre is very crucial in road safety. Therefore, consumers must be sensitized to know the appropriate usage and care for them. Taking appropriate care of the tyres is done by carrying out adequate wheel balancing, alignment and gauging of tyre pressure. It is only when this maintenance practice is done that one would be confident that premature structural distortion would not occur on the tyre. When this situation arises, would result to tyre failure. In Nigeria, there are a lot of external impacts that contribute to structural damage of tyres, such potholes, nails, debris etc. This type of damage leads to slow loss of the pressure (Osueke, C.O; Uguru-Okorie, D.C, 2012).

Under-inflated tyres overheat and overheated tyres commonly burst and if this happens when you are travelling at inappropriate speed, the potential for danger is clear. For over-inflated tyres, the central band of the tread pattern wears faster because the tyre has bulged. With over-inflated tyres, braking ability is reduced.

‘With the right amount of air pressure, tyres wear longer, save fuel, enhance handling and prevent crashes. Failure to maintain the correct air pressure can result in poor gas mileage, reduce tyre life, affect vehicle handling and cause vehicle overloading. Tyres do lose pressure daily, through the process of permeation. In warm weather, it’s common for tyres to lose air at a higher rate. Also, they are often subjected to flexing and impacts that can diminish air pressure as well.

Load is an important factor on tyres, overloading vehicles without paying any attention to the strain this put on tyres. Exceeding the maximum load capacity on a tyre would also lead to tyre failure and could result in a crash. Considering these factors, then the need to routinely check tyre pressure becomes imperative.

According to representative of Standard Organization of Nigeria (SON), good tyre must be new and should contain requisite marks on its side walls. The marks are its date of manufacture, name of the country of manufacture, brand name and “R” for retreading tyres. Other essential information includes tread wear number, temperature resistance, speed symbol, maximum load capacity and traction.

Older tyres are substantially more likely to fail than newer ones. This is because tyres are made mostly of rubber, and rubber degrades with age. Sunlight, heat, ice and general wear and tear can accelerate the breakdown of a tyre. The tyre aging process happens regardless of whether a tyre is on a vehicle or in a temperature-controlled store. Tyre aging is a “hidden hazard” because most consumers are not aware of tyre expiration. They age dangerously because of a chemical process commonly referred to as oxidation, which simply means that as the tyre components are exposed to oxygen (or air), the oxygen particles cause the flexible components of the tyre to harden and become brittle. Over time, the tyre would simply fall apart under normal stress, just like an old rubber band. Because this process occurs naturally, it does not matter if a tyre is being used, stored as a spare or simply waiting on a store shelf for unsuspecting consumer.

Road traffic crash is a major public health concern in Nigeria which is heightened because of bad and inadequate road network, poorly maintained vehicles among others. In a 2013 report by the World Health Organisation, there were 1,041 road fatalities per 100,000 motor vehicles in the country. Out of these fatalities, tyre burst have been identified as one of the top three factors that cause accidents on highways.

Incidents like these may not cease to occur as the country has become a dumping ground for all manner of tyres. There are many brands than ever before that a novice driver would have a hard time in identifying which is original (Jesusegun, 2014). Recent findings by the Corps indicate that 250 different brands of tyres are used in the country while some motorists use tyres meant for agricultural purposes on commercial vehicles, thus widening the gap in avoidable road traffic crashes (Oyeyemi, 2015).

David (1999) avers that the causes of most traffic accidents in Africa range from environmental, mechanical, to human factors. Among the mechanical factors are motor vehicle accidents that are attributable to tyres (Hananiya, 1996).

The extract below buttressed the implication of vehicle tyre failure to the motoring environment, as a single occurrence could cause unquantifiable loss of both human and material resources.

An accident at Igbogui market along the Ore-Benin highway has claimed the lives of dozens of

Nigerians. Eyewitnesses told Sahara reporters that over seventy passengers died when a luxury bus belonging to the Young Shall Grow Transport Company collided with a Dangote tanker laden with pms (fuel). The Federal Road Safety Corp (FRSC), however, reported that 36 persons died.

In a press release issued by the FRSC, the agency gave the cause of the accident as a tyre malfunction on the Dangote truck. "Preliminary reports from the FRSC indicated that a tyre from the Dangote truck suddenly pulled out and rammed into the Tanker which caught fire immediately,"

Sahara Reporters, New York Apr 05, 2013

The type of tyres a motorist has and the way they are made are critical factors for good traction, mileage and safety. Hence highway traffic administration has a duty to ensure that tyres meet prescribed safety standards and also educate the motoring public on tyre conditions. However, the weather, road condition, driving style and maintenance pattern of the tyre, play important role as variables to determine its performance and life span.

This study therefore provide an insight into the vehicle tyre usage among motorists and tyre failure on the highways with a view of providing safety measures and to awaken the consciousness of the motoring public towards safe driving with particular reference to Ondo State in Nigeria.

2 Methods

One hundred (100) motorists were sampled randomly to take part in this study and the sample was made up of males and females with age ranging from 18 to 67. The participants were drawn from Akure, Owo, Ore, Ikare, Ondo Town and Ifon because Federal Road Safety Corps' offices were located in those areas which would aid easy information or data gathering.

Among the inclusion criteria are that the respondents must be 18yrs and above, this is because 18 is the permissible age for driving in Nigeria while the vehicle owned/driven must be four-wheeled. Also, participants must be able to read and write in English, being the official language in the country.

2.1 Procedure

The main instrument for data collection of the study was a structured questionnaire. Observations were also used to complement the information gathered through the questionnaire method. The potential respondents were approached by the researcher and were told the purpose of the exercise after which their consents were sought with the assurance of absolute confidentiality.

Simplified questionnaires were taken to the field and administered to 100 respondents in the motoring public cutting across various strata (Private car owners, NURTW members, ACOMORON Members, etc) and all responded appropriately due to simplicity of the questionnaire. Observatory survey was also carried out in the process of administering the questionnaires. Data from the survey were subjected to simple quantitative analysis.

3 Results and Discussion

The personal information of the respondents include gender, age, educational qualification, year of driving experience, and possession of valid driver's license.

Table 1 shows that the study sample comprised 81 males and 19 females, (an indication of a male-dominant study) with age range of 18 and 67 years (and a mean score of 40.2 years). Their educational qualification also varied – 15 had FSLC, 20 had WASC/GCE/SSCE, 35 had OND/NCE, 25 had BSc/HND and the remaining 5 had Postgraduate degree. Their driving experience ranged from 1-25 years, with a mean score of 8.2 years.

Table 1. Personal Information of Respondents

Variable	Item	Frequency
Gender	Male	81
	Female	19
Age	18-27	3
	28-37	39
	38-47	42
	48-57	10
	58-67	6
Educational Qualification	Post Grad	5
	B.Sc/HND	25
	NCE/OND	35
	SSCE	20
	FSLC	15
Year of Driving Experience	1-5	31
	6-10	28
	11- 15	17
	16-20	18
	21-25	6
Possession of Valid Driver's license	Yes	66
	No	34

42% of the respondents fall within the most productive age (of 18 to 37yrs) which is in consonant with the number of respondents that fell within the age bracket of 38 to 47yrs.

All the respondents are educated with FSLC (being the least qualification), as ability to read and write is one of clauses for taking part in the study. Sixty-nine (69) of them have more than 5 years of driving experience sufficient enough to gain significant competency level of driving.

Sixty-six (66) of the respondents do possess valid driver's license which implies they have gone through the requisite driver's training.

Table 2. Vehicle Tyre Information, Usage and Failure

Variable	Response	Frequency	Percentage (%)
When do you purchase your tyres	Less than 1 yr	12	12.0
	1-2yrs	36	36.0
	3-4yrs	43	43.0
	5yrs or more	9	9.0
Tyre at the point of purchase	2 nd Hand	74	74.0
	Reborn	20	20.0
	New	6	6.0
Do you know that tyre expires	Yes	64	64.0
	No	36	36.0
What is the expiration period of a tyre	Right	17	26.6
	Wrong	47	73.4
How often do you travel along this route?	Daily	40	40.0
	Weekly	15	15.0
	Monthly	12	12.0
	Once in a while	33	33.0
Do you cover long distance?	Yes	76	76.0
	No	24	24.0
Have you experience crash while driving resulting from tyre failure?	Yes	52	52.0
	No	48	48.0
Source(s) of tyre failure	Insufficient/wrong maintenance (inflation pressure, over-aged)	27	51.9
	Production related failure (retreading tyre)	4	7.7
	Damage during operation (puncture)	20	38.5
	Failure related to tyre mounting	1	1.9

Table 2 shows that 76% of the respondents cover long distance either daily, weekly, monthly or occasionally along the route while 40% of them travel daily along the route.

More than one-quarter (26.6%) of the respondents who claimed to understand the reading of tyre expiration period are actually knowledgeable about it. While almost third- quarter (73.4%) of them failed the test of understanding. This outweighed the number of those who do not possess the valid driver's license showing that almost 20% (47-34) of the respondents who obtained the valid driver's license did so without passing through the compulsory drivers' training or the aspect of vehicle components and maintenance was not seen as relevant in the training manual.

Ninety-four (94) % of respondents had tyres which are fairly used at the point of purchase while fifty-two (52) % of the respondents had tyres which have spent 3years or more.

Fifty-two (52) % of the respondents have experienced crash while driving resulting from tyre failures. Based on the information the affected respondents inputted, it was observed that almost fifty two (51.9%) of them had insufficient/wrong maintenance as source of their tyre failures. This is greatly higher than the number of road traffic crashes (36.8%) investigated in Germany and reported under the authorship of Reithmaier & Salzinger in year 2003, attributed to failures due to insufficient or wrong maintenance. This Study confirmed that maintenance culture of drivers in Nigeria is greatly lower in comparison with that of Germany.

Almost thirty-nine (38.5)% of the respondents who have experienced crash while driving owing to tyre failures, had their tyres damaged during operation which is almost thrice the number of road traffic crashes investigated (14.6%) in Germany and reported under the authorship of Reithmaier & Salzinger in the year 2003, attributed to tyre damage during operation. This is clear evidence that the deplorable condition of Nigerian roads is one of factors responsible for tyre failures.

Table 3. Observational Survey on Respondent's Tyre Information

Variable	Item	Frequency	Percentage (%)
Tyre Make	Similar	31	31.0
	Different	69	69.0
With Expiry Date	Yes	72	72.0
	No	28	28.0
Number of tyres are expired?	Four	23	31.9
	Three	15	20.8
	Two	20	27.8
	One	3	4.2
	None	11	15.3

From the observatory survey, only eleven (15.3%) of the respondents had their vehicles fitted with tyres that are not expired. While respondents who possess sub-standard tyres equals the number of respondents whose vehicle tyre are without expiration dates (28) plus number of respondents whose four (4) tyres of their vehicles had expired (23) amounting to fifty one (51) in number. This almost equal the number of respondents (52), whose vehicle tyres have spent 3yrs or more. This is evidenced that majority of the respondents' vehicle are fitted at least one expired or substandard tyre.

4 Recommendations and Conclusion

The following recommendations are advocated to ensuring Nigeria is among the 20 safest countries in the world in 2020.

- The FRSC should beam its awareness on tyres by providing training on the various aspects of tyre codes and ratings, necessary to ensure safety on Nigeria roads. This knowledge gap is grossly lacking in drivers' training scheme.
- It is strongly advised that the drivers should emulate the right attitude towards the use of vehicle tyre rather than earn the consequence of neglect.
- As a matter of urgency, FRSC should further expand its operational frontiers to tackle the influx of tyres which fall short of recommended safety standards into the country as part of efforts towards meeting its 2015 strategic objectives of reducing road traffic crashes by 20% and fatalities by 30%.
- To secure Nigeria from being a dump site, there is need for stronger politically-motivated collaboration between the FRSC, National Automotive Councils and Standard Organisation of Nigeria. With this partnership, the hydra headed monster of sub-standardization which has impacted negatively in the system would be contained.
- The SON annual life-saving Campaign with other stakeholders known as 'Arrive Alive: Tyre Safety; Standards for Safety' for operators in various sectors and consumers on standardization as well as safety attitudinal change should be made a quarterly event. This would no doubt help to strengthen its awareness on the danger of using fake and substandard tyres by unsuspecting motorists.
- Road Audit Reports presented to relevant agencies such as FERMA, Ministry of Works and Transport

should be judiciously utilized by acting as spelt out in the recommendations of various reports.

It is pertinent to note that tyre is the most overlooked feature in a vehicle despite its importance. It is better to have a routine maintenance plan in relation to vehicle tyre than wait till failures occurred because these could lead to road traffic crashes when least expected.

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