

Causes of Tyre failure on Road Traffic Accident; A case study of Takoradi Township

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Abstract- Tyres are one of the active safety components on vehicles and also considered an important component in the legislative instrument in Ghana. As far as safety is concern, several studies have found out that tyre failure has impact on road traffic accident. This research looked into causes and effect of tyre failure on road traffic accidents on commercial vehicles in the Takoradi Township in the western region of Ghana as a case study. Survey research method was used in collecting data. Four hundred and fifty (450) questionnaires were personally administered to commercial drivers in the study area. The study found out that there were four major causes of tyre failure: over-inflation, under-inflation, wear and overloading of vehicles. The result further shows that tyres fail on the road, because more than 89 percent of drivers in the metropolis are not familiar with tyre information and most especially legal requirement on the minimum tyre tread depth in millimetres as enshrined in the legislative instrument in Ghana. It is recommended that the National Road Safety Commission intensify its campaign on the need for all commercial drivers to understand the importance of knowing and adhering to the Legislative instrument on tyres and how it can reduce Road Traffic Accidents, in order to achieve the Vision 2020 which aims to reduce road traffic accident by half by the year 2020.

Index Terms- Tyre failure, under inflation, over inflation, over loading, wear, vehicle accident

I. INTRODUCTION

Road crashes is an issue of global concern, the cost of road traffic accidents cannot be overestimated. Oduro (2012) stated that, the estimated costs as a percentage of the Gross Domestic Product (GDP) is about 0.8% in Ethiopia and 1% in South Africa, 2.3% in Zambia, 2.7% in Botswana, 5% in Kenya and 1.5 in Ghana. In Ghana, this translates to US\$ 418million on the management of the consequence of road traffic accident (NRSC, report 2010). This is exclusive of the pain, suffering and grief of the loss of bread winners and loved ones, and loss of scarce human resources. Road traffic accident is a public health concern which has to be addressed by concerted effort by all stakeholders. National accident data from the Road Safety Commission, (2013-2014 report) revealed that road traffic accidents had seen a minor decline as compared with the previous year, (2012-2013).

Road traffic accident is a global tragedy; they are major public health concern because of the high number of victims involved. Increase in road traffic accidents is closely linked with the growth of the population, economic development,

industrialisation and motorisation experienced by countries. A study conducted by Oduro (2012) indicate that Ghana in recent years has seen a dramatic increase in vehicular growth. The total vehicle population has increased more than 12% from 1.03 to 1.2 million between 2009 - 2010. A rough estimate of the service level in Ghana by the national Road Safety Commission (NRSC, report, 2013) indicates that about 22 million passengers and about 122million tons of freight is moved per annum by road. Road transport passenger services are predominantly provided by commercial transport services. By their sheer numbers, commercial road transport operations are involved in multiple vehicle accidents, which cause high rates of deaths and injuries to other road users. World Health Organisation report indicate that in general, about 1.3 million people die due to road accidents each year worldwide. The World Health Organisation (WHO) and the World Bank estimates that this number could rise by 67% until the year 2020 if nothing is done to minimise this effect. The international feature (IFs) forecasting model also anticipates that global traffic deaths will surpass 3 million per year by 2050 if nothing is done about it. United Nations Economic Commission for Africa (Report, 2014) also estimates that Africa accounts for 9% of world total road accident death. Dysfunctional tyres are seen as one of the major factors contributing to such road traffic death in Ghana according to the National Road Safety (report, 2013)

1.1 The pneumatic tyre

Tyres are made to grip the road surface when the vehicle is being steered, accelerated, and braked and or negotiating a corner, and so the ability to control the tyre in relation to its ground interaction is of fundamental importance to every vehicle (Heinz,2002).The pneumatic tyre serves two important purpose on all vehicles; it provides the vehicle with a frictional contact surface upon the road, and minimises the transmission of the road vehicle shocks associated with travelling over rough road surfaces. Generally, motor vehicle tyres are supplied as either tubed or tubeless (Read, 2000). A tubed tyre has an inner tube fitted inside the casing whilst tubeless tyres do not have an inner tube but relies on the bead of the tyre providing an air-tight seal when it is inflated against the rim of the wheel.

Depending upon the method of construction, a tyre can be categorised as either a cross-ply or a radial-ply. (Read, 2000) stated that because the ply of a cross-ply tyre can stretch while being pulled in different direction, it makes this tyre strong and also gives good load-carrying characteristics. However, the sidewalls of this tyre turns out to be stiff which limits the ability of this tyre to maintain full tread contact with the road surface especially when cornering. In contrast the radial tyre has a flexible sidewall which enables the tread pattern of the tyre to

remain in contact with the road surface particularly when cornering, giving it better grip on the road than the cross-ply tyre. In all circumstances, correct tyre inflation is essential for optimum performance. Correct tyre inflation ensures that the tyre has the maximum amount of tread contact with the road (Reithmaire and Salzinger 2003).

There are several factors that influence the ability of the tyre to grip the road when being braked, accelerated or steered, leading to tyre failure and resulting in road traffic accident. These may include, the speed of the vehicle, the amount of tyre wear, the nature of the road surface and the degree of surface wetness. Research conducted by (Reithmaire and Salzinger, 2003) in Germany indicate that a tyre of a tread depth below 3mm will lose about 50% of its available friction as compared to a brand new tyre.

Generally as the speed of the vehicle increased the time permitted for the tread to ground retardation is reduced so that the co-efficient of grip declines. As the depth of the tread is reduced, the ability for the tread to drain off water is reduced; therefore with increased vehicle speed inadequate drainage will reduce the grip of the tyre, resulting in a highly dangerous fault known as aqua-planing. Aqua-planing is a fault in which the tyre tread fails to clear the water on the road surface as the tyre contacts the ground Mudd (2009). Tyre failure may result in many types of crashes, often in indirect ways. Failure of the tyre can potentially result in reduced vehicle handling, increased braking distance and increased likelihood of blowout resulting in Road traffic accidents.

A study conducted by (Reithmaire and Salzinger 2003) indicated that between 3% to 7% of road fatalities are as a result of tyre failure. Similar research conducted by the National Road Safety Commission in Ghana also found out that 15.2 percent of all fatal accidents in the country were as a result of tyre failure (NRSC, Report, 2013). Tyres are the vehicle's only point of contact with the road and therefore the condition of a vehicle's tyre is an important safety factor. The shock absorbing qualities of a tyre is derived from its deflection under load. Mudd (1991) stated that the greater the deflection of the tyre the more comfortable its ride. The rated load per wheel supported by a correctly inflated tyre varies from about 35 to 50 times the weight of the tyre; this is dependent on the type of vehicle and the construction of the tyre. Several research indicate that there

are many causes of tyre failure leading to road traffic accidents. This research seeks to find the major causes and effects of tyre failure, using commercial drivers within the Sekondi Takoradi Metropolis in Ghana's western region as a case study.

II. RESEARCH METHOD

Survey research method (questionnaire) was used for data collection. (Floyd and Fowler, 2002) stated that survey research method has the ability to produce statistics, that is quantitative or numerical descriptive methods about some aspects of the study population. Generally, survey research methods also allows the researcher to collect data from a fraction of the population. That is, a sample, rather than from every member of the population. The study was to find out causes and effects of tyre failure on road traffic accidents. Five hundred (500) questionnaires with open ended items divided into about six sections were personally administered to drivers in the Sekondi-Takoradi Township, but only four hundred and fifty (450) drivers responded to the questionnaire, representing 90 percent of the respondents. Section one sought to find out how many years the drivers had been driving. Section two wanted to find out what the drivers think as to which of the tyre problem areas could lead to accidents in other of importance. Section three sought to find out from the drivers how many times in a month they checked their vehicle tyre pressures. Section four also wanted to find out if the drivers agree that tyre failure could lead to road traffic accidents. Section five enquired if the drivers in the Metropolis knew the minimum legal limit in millimetres that the tyre should be discarded and not be used in the country. The last section, section six, wanted to know if the drivers are aware that all tyres have an expiry date and if they knew where the expiry date on the tyre could be located.

III. RESULTS

Age of drivers

Four hundred and fifty (450) drivers responded to the questionnaire. Figure 1 shows distribution of the age of the drivers who responded to the questionnaires.

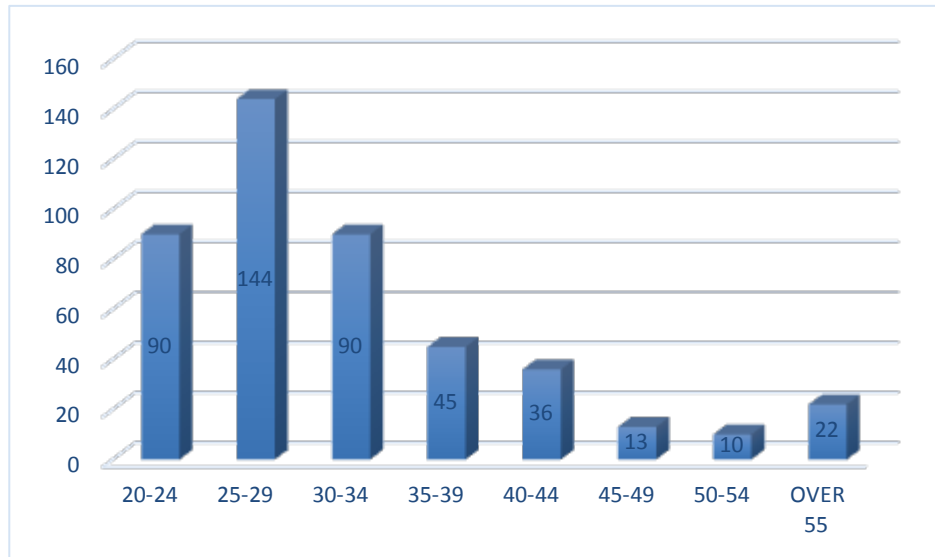


Figure 1. Age distribution of drivers

Driving Experience

Section one of the questionnaire wanted to find out how many years drivers had been driving after acquiring their driving

license. Figure two shows the distribution of the years of driving experience of the drivers.

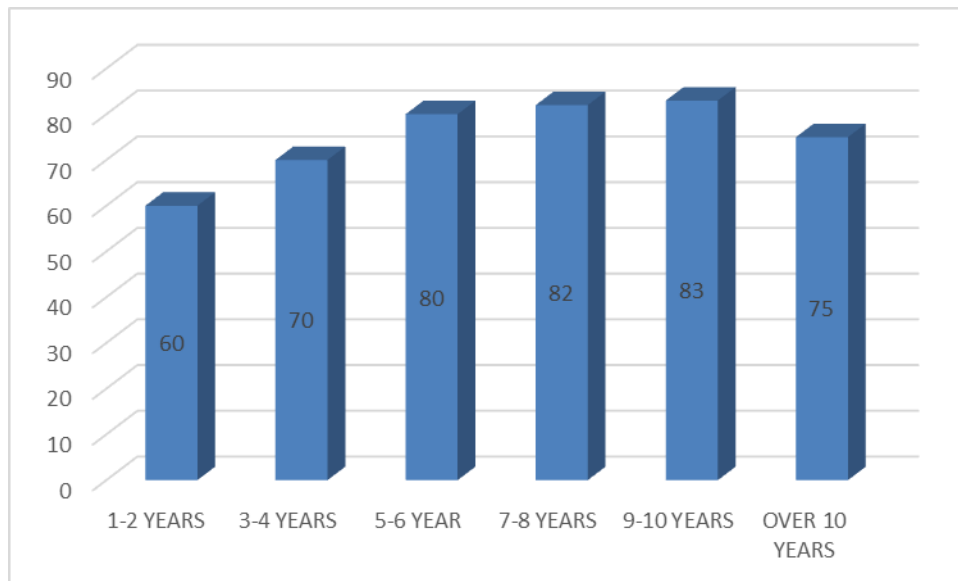


Figure 2. Distribution of driving experience in years

Tyre thread depth

Respondents were asked about the minimum legal tyre thread limit in millimetres for which a tyre should be discarded

and could not be used in the country. Figure 3 depicts the responses from the respondents.

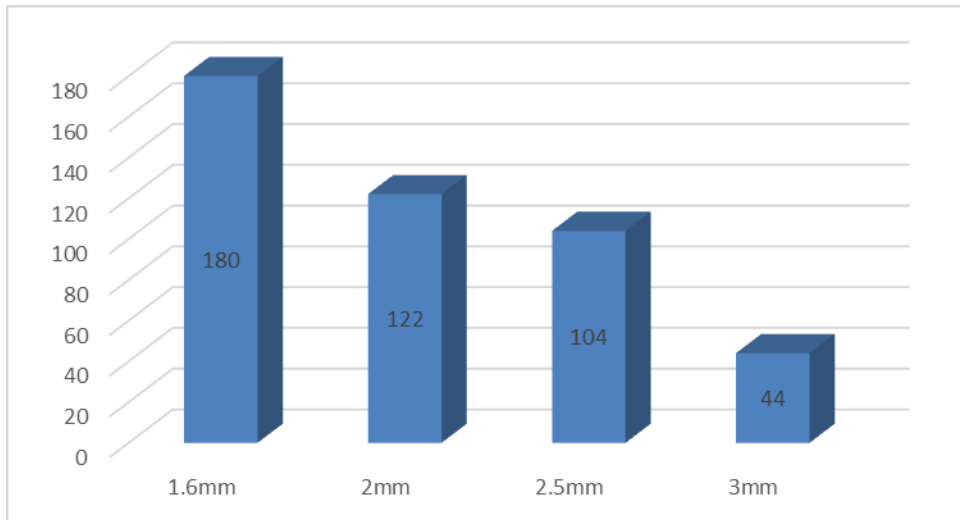


Figure 3. Tyre thread depth in mm.

Problems that could lead to tyre failure

Respondents were asked to select in the order of importance the problems that could result in tyre failure. Figure 4 shows the responses from respondents.

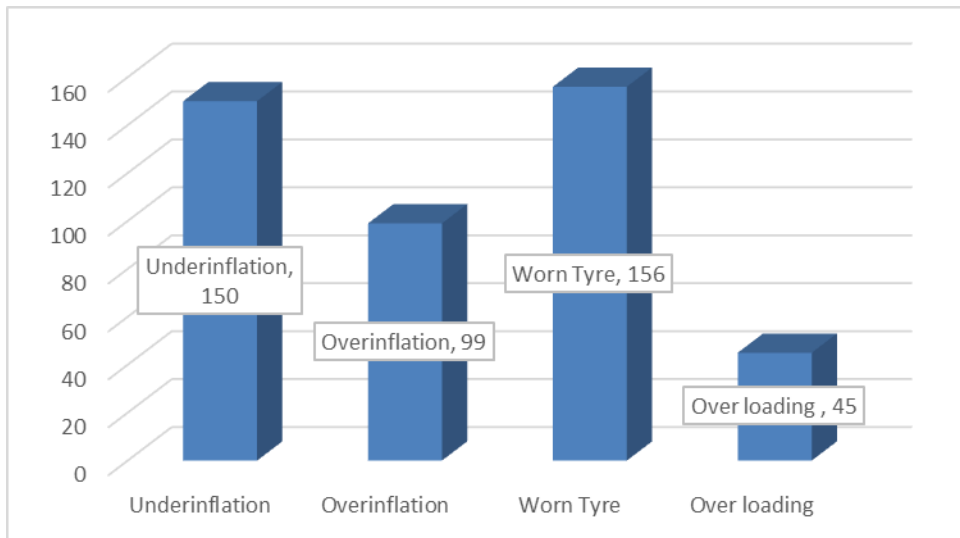


Figure 4. Problems that can lead to tyre failure

Tyre expiry date

Respondents were asked whether they knew all tyres have an expiry dates. Figure five depicts respondents' opinion.

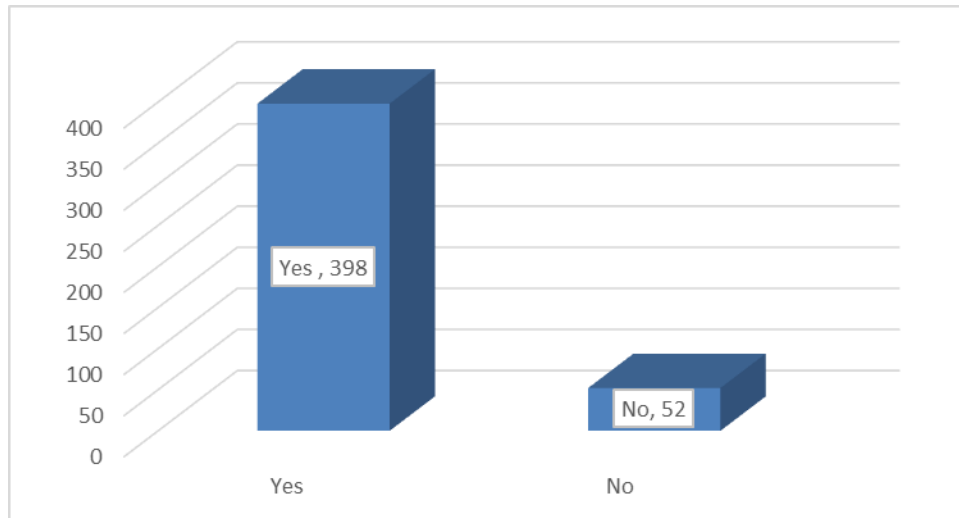


Figure 5. Expiring date on tyres

Location of tyre expiry dates.

Respondents were asked to locate on the tyre where the expiring date could be found. Figure 6 shows the result.

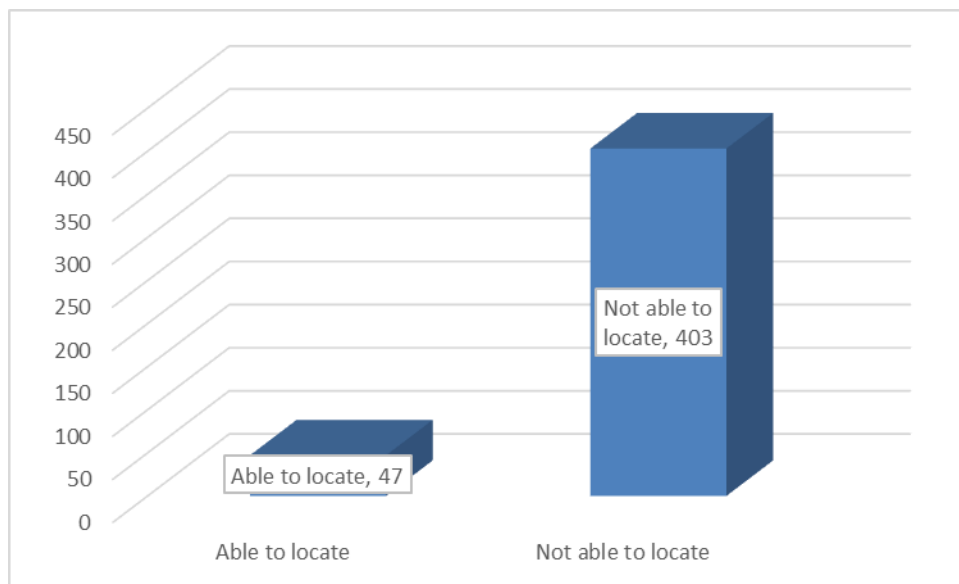


Figure 6. Where tyre expiry dates can be located

IV. DISCUSSIONS

Tyre information has a tremendous effect on road traffic accidents. This research looked into the causes and effects of tyre failure on road traffic accidents and found out that 89 percent of the drivers surveyed were not familiar with tyre information as provided in the laws of Ghana.

Sixty (60) percent of the respondents were not aware that a tyre with a thread depth of less than 1.6 millimetre should be discarded and not to be used in the country. Ghana's Legislative Instrument, (LI- 2180) Section 62, subsection 1(d) States that, unless the Licensing Authority permits in writing, the importer of a motor vehicle or trailer shall ensure that; the minimum tread

depth for a tyre is not less than 1.6 millimetres for all categories of vehicles.

The use of tyres with thread depths of less than 1.6 millimetre is thus unlawful and could lead to failure in an emergency situation. Majority of the respondents (88%) in the Metropolis were aware that tyres have expiring dates, but 90 percent of them do not know where the expiry date of a tyre could be located, meaning they could not determine if the tyre they were using had expired or not. This confirms the result of a research done by Ghana's National Road Safety Commission (NRSC, Report, 2013) which found out that more than 50 percent of the drivers in the country were not familiar with tyre information available to consumers on the sidewall of a tyre. The

lack of knowledge on vehicle tyre expiry dates could lead to fatal road traffic accident as a result of tyre failure.

One hundred and fifty six (156) of the respondents, representing 35 percent believed that tyre failure was as a result of worn tyres. (Fig. 4) 150 of the respondents representing 33 percent attributed tyre failure to under-inflation; another 99 of the respondents representing 22 percent also believed that tyre failure is as a result of over inflation; 45 respondents also representing 10 percent believed that tyre failure is as a result of over-loading of the vehicles.

These responses from the drivers in the Takoradi Metropolis in Ghana confirm that majority of drivers appear to know the impact of tyre failure but are indifferent when it comes to taking action to forestall its occurrence and its effect on road traffic accidents.

V. CONCLUSIONS

This research looked into the causes and effects of tyre failure on road traffic accidents, using Takoradi Metropolis as a case study and found out that commercial drivers are aware that there are four major causes of tyre failures which include, over inflation, under inflation, overloading and excessive tyre wear. These failures are as a result of human error on the part of drivers who though know of the existence of the problems but fails to seek knowledge on tyre information. This research confirms a research undertaken by Wheat (2005) which stated that 93 percent of all road traffic accidents are as a result of human error.

Most drivers (90 percent) in the Metropolis are not familiar with tyre information which are inscribed on the sidewalls of the tyres. Also, many drivers (60 percent) did not even know that tyres which have a thread depth of less than 1.6 millimetres should be discarded and not used according to Ghana's laws (LI 2180). Accordingly, when tread depths are below 1.6 millimeters road traffic accidents rate are trebled and even increases seven-fold when the tread depths go below 0.5mm. (Bullas, 2004). Tread depths below 0.5 millimeters could also result in a fault known as aquaplaning, a situation where the tyre fails to clear the water on the road when the tyre contacts the ground. Mudd (2009).

VI. RECOMMENDATIONS

- This research recommends that tyre information should form part of all DVLA driver training examination

questions so that drivers' knowledge on tyre information could be ascertained;

- the National Road Safety Commission and the DVLA should put policies in place to ensure that all vehicle users comply with the National standards on tyre tread depths of 1.6mm;
- The Ghana police service should ensure that the standards on tyre tread depths are complied with;
- The NRSC should intensify its campaign on the importance of tyre information to all vehicle users in the Takoradi metropolis where this research covered.
- Law enforcement on tyre tread depth needs to be strengthened to ensure compliance with international best practice.

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