ISSN: 2756 – 4118 *African Journal of Science Policy and Innovation Management* Volume 1, Issue 2. December, 2020
ajspim.oauife.edu.ng

DYNAMICS OF ROAD MISHAPS INVOLVING PETROLEUM PRODUCTS VEHICLES IN SOUTHWESTERN NIGERIA

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ABSTRACT

Transportation of petroleum products by road in Southwestern Nigeria has been inundated with a high number of accidents that is often associated with safety consequences and gross disregard for standard regulations and guidelines. This research paper focused on the dynamics influencing the high rate of Petroleum products vehicle road mishaps in Southwestern Nigeria. The route from Lagos to Akure and Lagos to Ogbomosho were considered, and data was collected from a total of 150 respondents comprising of tanker drivers, tanker owners and FRSC officials using a set of questionnaire. The results showed that 77.1% of the drivers consume alcohol while driving, and 97.9% learnt how to drive in the informal way, while FRSC regulations stipulates otherwise. All (100%) of the drivers have never gone for eye test which is one of the major requirements for issuing and renewing driver's licenses. More than 90% of the respondents agree that drivers age, experience, and health and eye conditions greatly influence the occurrence of articulated vehicle accidents. The analysis of mean shows (on a scale of 1 = low to 5 = very high) that long trip hours (3.95), bad road carriageway (4.02), unavailability of road signs (4.08), driving-under-influence (DUI) of alcohol (4.87), malfunctioning braking systems (4.87) and fitting wrong axle specification on vehicles (4.97) are key factors influencing articulated petrol tanker accidents. In conclusion, accident of articulated petroleum vehicles can be reduced if concerned stakeholders can adhere to procedures, regulations and policies provided by related government agencies regarding driving on the highway and if roads and vehicles are kept in good condition and maintain manufacturers' standards. In addition, there should be greater enforcement of laws for driving under the influence of alcoholic drinks and policies for eyes test, health fitness checks and psych evaluation. Lastly, government should endeavor to make swift repairs on major roads and road signs.

Key words: Articulated vehicle, Accidents, DUI, RTC, Transportation, Petroleum products, Tanker drivers.

1.0. INTRODUCTION

The global petroleum industry is currently giving attention to risk, safety and environmental management due to the potential of operational accidents/incidents with devastating consequences to human safety and the environment (Eduljee, 2000; Hopkins, 2012). According to the International Monetary Fund (IMF) (2014), the Nigerian economy is majorly anchored on the petroleum industry. This industry accounts for more than 95% of export earnings and over 89% of government revenue. Moreover, the sector has been criticized for poor safety performance and air, land and water pollution. This has led to poor ecological quality. Poor

safety, operational activity and environmental undertakings within the industry has been attributed to poor technical infrastructure, accidents and vandalism (Zabbey, 2009; UNEP 2011; Adewuyi and Olowu, 2012; Chukwudi, 2012). The petroleum industry in Nigeria consists of two nodal streams of operations, namely; the upstream and the downstream. Operations in the upstream include: oil exploration and development; and production and transportation of crude oil and petroleum gas (Charles, 1999; Baaziz & Quoniam, 2014; Shafiee *et al.*, 2019). Alternatively, downstream operations include crude oil refining, transportation of processed petroleum products and distribution and product retailing. All of these activities can prospectively cause damage to human safety and the environment as a whole. It is interesting however, that research attention tends to focus more on accidents emerging from the upstream petroleum industry operations in Nigeria (Zabbey, 2009; Kadafa *et al*., 2012), such as environmental pollution occurring during exploration and production of petroleum and accidental or deliberate crude oil spillage.

The reason for the attention given to upstream risk research may not be unconnected with the erroneously perceived importance of the upstream subsector. Whenever mishaps occur within the downstream points of operations lead not only to wanton economic losses, but also serious safety and environmental consequences. This is because no sufficient generically accepted risk management framework has been developed for measuring, assessing, interpreting and mitigating safety and environmental risks from road mishaps in operations within the downstream sector particularly road transportation of the Nigerian petroleum industry (Ambituuni *et al*., 2014). Petroleum products can be transported by pipelines, rail, marine and road (API, 2013). Although, pipelines are comparatively more economically viable in terms of distance coverage, accessibility and efficiency (Oni, 2002, Shaton et al., 2019), the total collapse of transport infrastructure in Nigeria of particular the rail system and the near absence of water transportation within the hinterland, makes pipeline and truck systems the main mode of petroleum product transportation and distribution. Many pipeline systems around the globe, are not on secure industrial sites but are routed across land, that is, through busy city centers and network of highways. In Nigeria as well, transmission pipelines carrying liquid petroleum products are no exemption (Osland, 2013).

Consequently, third-party interference with the integrity of these pipelines is eternally hard to bring to a halt. Furthermore, the integration of third-party interference and pipeline routes might signify that people around the pipelines are exposed to significant risk from pipeline systemic failure. Though in many countries, pipeline infrastructure presents the most effective, efficient, safe and environmentally friendly means of transportation for petroleum products over long distances, Nigeria is a far cry from the norm, as vandalism and pipeline repression has been linked to catastrophic disasters (Adishi and Hunga, 2017). This is one of the reasons there is considerably high road haulage operations for petroleum products in Nigeria. It is estimated that about 95 percent of total petroleum products volume transported by road is done using articulated vehicles of between 33,000 - 60,000 litre capacities. A daily average of 5,000 articulated petroleum vehicles are involved in wet product cargo haulage and 1,500 trailers in dry cargo haulage on poorly maintained Nigerian roads (FRSC, 2011; Gershon and Asaolu, 2020). Similar to the pipeline system, road-truck transportation contributes to safety and environmental issues as documented by SAVAN (2002), Dare *et al*. (2009), Anomohanran (2011) and BBC (2012). Both modes of product transportation and distribution (pipeline and road-trucking) are characterized by rampant occurrence of accidents, vandalism and related fire disasters. In many developing countries, Nigeria inclusive, accidents involving

transportation of petroleum products by road has been associated with high frequency of occurrence and high safety consequences. Quite often, many researchers have identified poor quality of roads as a major drawback for transportation of petroleum consignments, in spite of the fact that road haulage has been and still remains the most favored mode for the movement of petroleum products (Oni, 2008; Chikwe, 2019). The National Bureau of Statistics (NBS) (2020), published in its second quarter report that 98 petroleum tankers were involved in fatal accidents across the country. A fully loaded petroleum tanker with 45,000 liters capacity cost ₦55,200,000 (Fifty-five million two hundred thousand naira only) if it assumed to be loaded with petrol. Hence for the second quarter of 2020, the Nation had lost this amount ninety-eight times, which gives ₦5,406,600,000 (Five billion, four hundred and six million, six hundred thousand naira only). This is a colossal loss that needs to be mitigated. This study thus seeks to probe factors that influence road accidents involving petroleum products vehicles to inform mitigation mechanisms.

2.0. Literature Review

A study on unsafe driving acts in serious traffic crashes to determine the specific driver behavior, the role of infrastructure, and unsafe driving acts that lead to crashes, and the situational, driver and vehicle characteristics associated with these behaviors was conducted by Hendricks *et al* (1999). In the study, the authors used an 11-step process to evaluate the crash, determine the primary cause of each crash and uncover contributing factors. The crash types were recorded into seven classes with operational differences that were likely to be associated with driver behavior/performance. Consequently, it was discovered from the study that crash causation factors can be categorized into vehicle condition, environmental condition, driver behavior, roadway condition and others. It was also reported that driver behavior caused or contributed to 99% of the crashes investigated. In a similar vein, the Federal Highway Administration (FHWA) (2009), conducted a study and showed that highway bottlenecks arising from delays is estimated to be caused by non-recurring congestion, that is, reduced frequency of traffic. The result of transitory events like construction work zones, crashes, breakdowns, extreme weather conditions and suboptimal traffic control are all cases of delays in freight transport delivery. Consequently, the report notes that truck delay bottlenecks increase costs to business and consumers and at times imposes fatigue on the driver thereby causing accidents. Aworemi *et al*., (2010), showed that human characteristics, vehicle characteristics, and roadway and environmental characteristics made a joint significant contribution to about 79.4% of the road traffic crashes in Southwestern part of Nigeria. This is in agreement with earlier studies carried out by Iyang (1991), Ogunsanya (1991), Asogwa (1992) and Dixey (1999). These authors all agreed that the aforementioned characteristics among others are the principal causes of road traffic crashes in some developing and developed countries across the world. In a radical deviation from these researchers, Bates (2004) opined and substantiated that certain pedestrian behavior, such as walking along the roadway with traffic, and crossing a roadway at a point other than an intersection are significant in fatal crashes. Bates' (2004) findings go a long way in determining causes of road mishaps in many developing countries with little or no road signs and pedestrian bridges, coupled with low road usage awareness.

In other schools of thought, accident studies are centered on age and gender of drivers as important risk factors. Median-aged drivers exhibited a lower risk of serious accident involvement relative to young and old drivers (H´ıjar *et al*., 2000; Norris et al., 2000; Massie *et al*., 1995; Derrig *et al.*, 2002; Zhang *et al.*, 2000; Valent *et al.*, 2002). There was usually a

greater probability that male drivers would become involved in serious accidents (Massie *et al*., 1995; Zhang *et al.,* 2000; Valent *et al.,* 2002; Yau, 2004). The importance of age and gender suggested the specific safety needs to be addressed according to these demographic characteristics (Bedard *et al.,* 2002). Risk homeostasis theory (RHT) which was developed to explain behaviors of individuals and the propensity to experience a traffic accident states that road users perceived a certain level of accident risk in a given situation, perceived level of risk (PLR), which was compared with the level of accident risk they were willing to accept, that is, the tolerable level of risk (TLR). Whenever there was a discrepancy between the two perception levels, the individual would make behavioral adjustments to re-establish the balance (Wilde, 1986). An individual would not have continued to experience more risk than they wanted intuitively. According to Taiwo (2007), most drivers take for granted the ability of their automobile to handle minor road hazards such as pot holes or rail road tracks. These minor road hazards are major problems for petrol tankers because these hazards may require sudden changes of lane position and direction.

Accidents due to petrol tankers especially in developing countries like Nigeria increase every year due to the fact that the petrol tanker drivers do not follow the traffic rules and the drivers believe they are the king on the roads (FRSC, 2007). The study further reported that petrol tanker crashes are more likely to occur in certain times especially raining seasons in Nigeria. This is due mainly to water filled pot holes and slippery surfaces of the roads during the season. Taking a look at the risk homeostasis theory, which holds that the rate of traffic accident in a particular geographical area over a specified time period is a direct function of the total amount of time spent in traffic by the aggregate population in that area. Wilde (1982), and Trimpop (1996), looked at the behavioral aspect of risk homeostasis theory that posits that people at any moment in time compare the amount of risk they perceive with their target level of risk and will adjust their behavior in an attempt to eliminate any discrepancies between the two. What this simply means is that there is a level of risk that people are willing to take generally. And once that level of risk is exceeded or reduced, they tend to adjust accordingly, so as not to go beyond the level of risk they can accept.

3.0. Methodology

The primary source of data was a structured questionnaire administered to tanker drivers, FRSC personnel and petrol tanker owners. The sample area includes Lagos, Oyo and Ondo States. These States were purposively selected because they are the only States in the region with petrol depots where petroleum products can be loaded on to tankers. The questionnaire was designed to obtain information on the demographic characteristics of the respondents and causes of road accidents among petrol tanker drivers in southwestern Nigeria. A total number of one hundred and fifty (150) respondents comprising of petrol tanker drivers (75), FRSC personnel (15) and petrol tanker owners (60) in southwestern Nigeria were sampled for the study. The findings were presented in descriptive form using frequencies, percentages, mean ratings and standard deviations. The sequence of presentation in the questionnaire was presented with the bio-data of the respondents and the research question.

4.0. Results and Discussion

Table 1 revealed that the 14-wheel 30-ton truck is the most predominant (62.5%) articulated vehicle being used to transport petroleum products in the study area. Invariably, when the frequency is considered, it means the 14-wheel 30-ton truck may be rife in petrol tanker accidents in Southwestern Nigeria; all things being equal. Policy formulation may be geared

towards having assembly plants or more importantly manufacturing plants for production of 14-wheel 30-ton trucks in the country.

Table 1: Types of Articulated Vehicles in the Study Area

S/N	Types of Articulate Vehicle	Frequency	Percentage (%)
1	14 Wheels 30 tons	30	62.5
2	14 Wheels 40 tons	4	8.3
3	18 Wheels 45 tons	5	10.4
4	14 Wheels 25 tons	8	16.7
5	18 Wheels 60 tons	1	2.1

From Table 2, it can be seen from the percentage distribution of the marital status of respondents that married people dominated the petrol tanker driver sector, accounting for 91.7% of the total respondents. One can infer from the result that extra caution is expected to be maintained among the petrol tanker drivers since most of them are married and ought to have been responsible and mature as was reported in studies done by Hamed *et al.,* (1998); Dare *et al.,* (2009); Phillip *et al.,* (2010) and Zhang *et al*., (2016). In the same vein, 97.9% of the drivers learnt how to drive from the informal sector where there are no rules of any kind and safety learning is next to nil. Yet the individuals that learnt through this means are able to secure a driver's license. This goes against the FRSC requirement that a certificate of a driving school is required to obtain a driver's license. This shows a gross policy implementation neglect. Similar outcome was reported in Otu *et al*., (2018). A meagre 2.1% of the drivers surveyed learnt how to drive a petrol tanker from the driving school.

The prevalent (41.7%) age of the drivers was between 35-50 years of age which is the active working age in a man's life. Hakkola, 1996; Jarvholm, 1997; Obasanjo, 2014; and Ozoh, 2017 reported similar results. In the study area, it was observed that there was no female petrol tanker driver, as all the respondents (100%) were male. In the study carried out by Boucher *et al.,* (2013); Ayuso *et al*., (2016) and Gao *et al*., (2019), it was reported that female drivers are less likely to have a road mishap than male drivers. Furthermore, 47.9% of the respondents have been driving for more than ten years. Driving experience brings about maturity and composure needed for a petroleum tanker driver. The more the experience on the wheel, the more accustomed to the road drivers become; hence reducing the propensity to be involved in road mishaps (Chen *et a*l., 2017; Li *et al*., 2018; Medizadeh *et al*., 2081; Li *et a*l., 2020). While the greatest bodily organ needed for driving a petrol tanker is the eye, it is surprising to see from the table above that no one (100%) amongst the respondents had ever gone for an eye test. This was also reported by Fasina *et al*., (2020). In the course of this study, the drivers were not subjected to an eye test, but it was discovered that the FRSC mandatorily conducts simple eye tests before issuing a driver license and the license is expected to be renewed every 3-5 years. It is on record as well that the truck owners do not ask for an eye test certificate before employing the drivers, so even if the driver were to have any sight defects it cannot be detected.

Table 2: Socio -Economics Characteristics of the Respondents (Petrol Tanker Drivers)

S/N	Characteristics		Frequency	Percentage (%)
1	Gender	Male	48	100
		Female	0	0
2	Age	21-34	16	33.3
		35-50	20	41.7
		51-60	10	20.8
		>60	2	4.2
3	Marital Status	Single	4	8.3
		Married	44	91.7
4	Education Qualifications	No Formal Education	10	20.8
		Primary Certificate	25	52.1
		Secondary Certificate	13	27.1
5	Work Experience	0-5	5	10.4
		6-10	20	41.7
		>11	23	47.9
6	Alcohol Consumption	Yes	37	77.1
		No	11	22.9
7	Eyes Test	Yes	0	0
		No	48	100
8	Smoking	Yes	11	22.9
		No	37	77.1
9	Place of Learning	Driving School	1	2.1
		Informal Learning	47	97.9

Meanwhile, about 77% of the drivers consume alcohol to various degrees. This is in line with the study of Makanjuola, *et al.*, (2014) and Usman, (2015). A cursory look at table 3 showed that respondents agreed (4.05) that drivers age is a significant factor of road mishaps. Similarly, they agreed (3.98) that work experience, training (4.008), and health condition (3.9912) are all significant factors in road mishaps of petrol products vehicles. This is in tandem with the findings of Hakkanen *et al.*, (2001); Phillip *et al*., (2003); Souza *et al*., (2005) and Girotto *et al.*, (2016).

Table 4 represents the operational factors. Respondents agreed (3.9) that trip hours on the road is a major factor that can influence the accident of a petrol products vehicle. This result is similar to findings by Biliyamin *et al*., (2012) and Bako *et al*., (2017) that the more the truck

driver stays on the road, the more fatigued they become thereby exposing the driver to a higher risk of having an accident. They went further to suggest truck stops be provided along the highways to enable the drivers to take a break from driving. Respondents are undecided (3.4) that distance travelled which often times leads to fatigue on the driver and can greatly influence accident of petrol products vehicles. Undoubtedly, alcohol consumption while on the wheel can greatly influence the accident of petrol products vehicles. Respondents strongly agreed (4.8) that alcohol consumption while driving is a significant factor of road mishap of petroleum vehicles. In the work of Makanjuola *et al*., (2014), it was discovered that the rate of accidents was significantly higher among current alcohol users (43.8%). This is also in line with the work

Table 3: Human Factors

Characteristics	SD	D	U	A	SA	Mean	Standard Deviation
Drivers Age	0(0%)	0(0%)	1(9%)	105(92.9%)	7(6.2%)	4.0531	0.26189
Drivers Selection	0(0%)	108(95.6%)	5(4.4%)	0(0%)	0(0%)	2.0442	0.20656
Education	0(0%)	110(97.3%)	3(2.73%)	0(0%)	0(0%)	2.0265	0.16148
Work Experience	0(0%)	0(0%)	5(4.4%)	105(92.9%)	3(2.7%)	3.9823	0.26667
Training	0(0%)	0(0%)	0(0%)	112(99.1%)	1(9%)	4.0008	0.9407
Eyes Condition	0(0%)	0(0%)	0(0%)	113(100%)	0(0%)	4.0000	0.0000
Health Condition	0(0%)	0(0%)	1(0.9%)	112(99.1%)	0(0%)	3.9912	0.09407

Keynote: SD= 1, D=2, U=3, A=4, SA =5 (SD=strongly disagreed, D=disagreed, U=undecided, A=agreed, SA=strongly agreed)

Table 4: Operational Factors

Characteristics	SD	D	U	A	SA	Mean	Standard Deviation
Trip Hours	0(0%)	2(1.8%)	1(.9%)	110(97.3%)	0(0%)	3.9558	0.27997
Distance Travelled	0(0%)	23(20.4%)	12(10.6%)	78(69.0%)	0(0%)	3.4867	0.81411
Systems of Discharge	0(0%)	112(99.1%)	1(.9%)	0(0%)	0(0%)	2.0088	0.09407
Spare Driver	1(.9%)	110(97.3%)	2(1.8%)	0(0%)	0(0%)	2.0078	0.16342
Traffic Holdup	1(.9%)	81(71.7%)	5(4.4%)	26(23%)	0(0%)	2.4956	0.85695
DUI	0(0%)	0(0%)	1(.9%)	12(10.6%)	100(88.5%)	4.8761	0.35689

Key Note: SD= 1, D=2, U=3, A=4, SA =5. (SD=strongly disagreed, D=disagreed, U=undecided, A=agreed, SA=strongly agreed)

of Oridota *et al*., (2013), though the study went further to show that road traffic crashes increased with increasing driving hours and years of experience.

Table 5 represents the equipment/infrastructure factor, and it clearly showed that respondents strongly agreed (4.9) that wrong axle specification is a significant factor of road mishap among petroleum vehicles. This was noticed in the course of this study, with some trucks built for 15 tons load being converted to carry 25-ton loads. Respondents also strongly agreed (4.8) that badly maintained braking systems is a significant factor of road mishaps. Agreement was also reached in road status (4.07), number of lanes on the roads (4.0) and availability of road signs (4.0), as being significant factors that influences the occurrence of accidents of petrol products vehicles in the study area. Many of the respondents clearly understand the effect of assigning the wrong load axle to a vehicle but still go ahead to do it anyway, citing economic reasons. The road status is also another factor that most respondents agree upon, and this is in line with the findings of Osime *et al*., (2007) that one of the major contributors to fatal Road Transport Crashes (RTCs) include the increased demand for used vehicles over new ones, the state of road disrepair over a long period, and the increasing maintenance-neglected roads. In the work of Jaiye *et al.*, (2020), similar findings were reported.

Table 5: Equipment/Infrastructural Factor

ITEMS	SD	D	U	A	SA	Mean	Standard Deviation
Axle specs	0(0%)	0(0%)	0(0%)	2(1.8%)	111(98.2%)	4.9197	0.13244
Tank Materials	5(4.4%)	98(86.7%)	4(3.5%)	6(5.3%)	0(0%)	2.0973	0.53393
Brake System	0(0%)	0(0%)	0(0%)	19(16.8%)	94(83.2%)	4.8319	0.37566
Tank Hatch	1(0.9%)	106(93.8%)	4(3.5%)	2(1.8%)	0(0%)	2.0619	0.3496
Fire Extinguisher	1(0.9%)	106(93.8%)	5(4.4%)	1(0.9%)	0(0%)	2.0531	0.29401
Valves Specs	0(0%)	106(93.8%)	7(6.2%)	0(0%)	0(0%)	2.0619	0.24213
Road Status	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	4.0708	0.25763
Dual/Single way	0(0%)	0(0%)	1(0.9%)	111(98.7%)	1(0.9%)	4.0024	0.18363
Road Signs	0(0%)	0(0%)	0(0%)	112(99.1%)	1(0.9%)	4.0008	0.09402

Key Note: SD= 1, D=2, U=3, A=4, SA =5. (SD=strongly disagreed, D=disagreed, U=undecided, A=agreed, SA=strongly agreed)

The study found that majority of petrol tanker drivers in the study area are within 30 and 50 years of age. This category of people are in their late adolescence and early adulthood years and may be distinguished by reckless and uncouth driving behavior. This finding is in support of earlier studies (Massaeid, 1996; Bevan *et al*., 2014; Yeung and Wong, 2015; Ahmad *et al*., 2019;) that age of tanker drivers was a determinant factor responsible for the cause of accidents on the highway as the age of the driver affects the years of driving experience due to the tedious nature of petrol tanker driving. Similarly, this finding corroborated the findings of Adisa (2010) and Obasanjo *et al*., (2005) who earlier reported that petrol tanker drivers are more dominated by males than female (99%). The level of formal education of the respondents reveals that most petrol tanker drivers do not have formal education or that they dropped out of school at an early age. This may account for the high level of ignorance among them, as most cannot interpret road traffic regulations or signs. This finding was corroborated by Ngim and Udozen (2007) and Dosunmu, *et al.*, (2016).

Furthermore, the study reveals that factors influencing the rate of petrol products vehicle accidents have been found to include; age, work experience, training, and health condition, trip hours on the road, distance travelled which often times leads to fatigue on the driver, alcohol

consumption while on the wheel with mean ratings of 4.05, 3.98, 4.00, 3.99, 3.95, 3.48, and 4.87 respectively. These findings agreed with the previous studies (e.g., Meuleners *et al.*, 2007; Nahakara *et al.*, 2005; Njim and Udozen, 2007; Horsewill and Helman, 2003; Nigerian highway codes, 2008; Adisa, 2010; and Ogagaogene, 2011). These findings were in support of the view of Odero, *et al* (1997); Akinlade, (2000); and the Nigeria Highway code (2008). Poor knowledge of traffic code and the desire to cover more distances at a shorter time was also found to be a significant factor responsible for high rates of accidents among petrol products vehicles. Consistent with previous studies, Makanjuola, 2014; Chukwuma, 2015; Usman *et al*., 2015; Aderibigbe, 2017; and Olawole and Olapoju, 2018, where alcohol consumption and substance abuse, bad roads with various pot holes, and the use of old and outdated trucks has been identified as possible factors causing accidents of petrol tankers.

5.0. Conclusion

The study reveals that, age, work experience, training and health condition, trip hours, distance travelled, alcohol consumption, types of road carriage, absence of road signs, and bad roads accounted for the factors that cause high rate of accidents among petroleum products vehicles. The study further shows that compliance with regulations by both the drivers and the FRSC personnel is low. Many of the drivers do not learn how to drive a tanker at a driving school, yet they all have a driver's license. Even though it is a criterion set up by FRSC that a driving school permit is a pre-requisite for obtaining a driver license. The study also showed that majority of the petroleum products vehicle drivers have never gone for an eye test, many of them take alcoholic drink before driving, and most of them do not have educational background beyond primary school and hence, some cannot decode the rules and regulations guiding driving.

5.0. Recommendations

Based on these findings, the study recommends that adult literacy classes should be provided by the government for petroleum products vehicle drivers in Nigeria so that they will learn how to read and write and understand road safety regulations and guidelines. In addition, there should be greater enforcement of laws for driving under the influence of alcoholic drinks and policies for eyes test, health fitness checks and psych evaluation. Lastly, government should endeavor to make swift repairs on major roads and road signs.

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