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RESEARCH ARTICLE

Modification of Road Infrastructure to Increase Driver Compliance in Uganda

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Abstract

Deteriorating driver behaviour over the last decade is documented as the leading contributor to the increasing rate of accidents on roads in Uganda. Studies done in this area have blamed the bad driver behaviour to social norms and the loop holes in the safety regulation enforcement system to ensure driver compliance. Besides the social and regulatory environment, poor road infrastructure has had a great influence on the driver's compliance levels in the country. It is probable to infer that the state of the road infrastructure is highly responsible for driver non compliance to safety regulations from this study's findings. The inferences made in the paper are a result of the findings from data collected from 285 respondents comprising of traffic officers and analysed using SPSS. The study also critics the Risk Homoeostasis Theory and makes numerous contributions to theory, policy implications and recommendations to improve road safety.

Keywords: Driver compliance, Road infrastructure, Roads, Uganda.

Introduction

During the year 2000, the Government of Uganda developed a five year road safety programme with a three year National Road Safety Action Plan whose implementation started in 2004 to build capacity in form of physical improvement of critical black spots responsible for most fatal accidents on major highways. Statistics show that environmental factors and road conditions contribute 5percent, bad driver behaviour; 80per cent and defective vehicle condition; 10per cent, to the increasing number of accidents in the country, Baguley and Jacobs [1]; Nassasira [2]; Wilde [3]. In year 2000, there were 14,390 reported accidents with 1,438 fatalities and 12,946 injuries compared to 2008 which had 18,250 reported accidents with 2,334 fatalities and 12,076 injuries, Nassasira [2]. Hospital based studies in Uganda showed pedestrians as the most frequent traffic casualties (43.5per cent), followed by vehicle occupants (31.9per cent), Mutto et al [4]. Road accidents cost the country between 1-3per cent of GDP in terms of lost lives, injuries, vehicles and property damage, Bishai et al [5]; Mutto et al[4]; Nasasira [2]. According to Baguley and Jacobs [1], approximately 1 per cent of Uganda's annual gross national product (GNP) is lost to road accidents. Because of this, the government of Uganda has over the years increased funding for the Ministry of Works and Transport (MOWT) in the national budgets in order to improve road infrastructure and also support the development of the national strategic framework that aims at reducing the road crash deaths in the period 2010 - 2020 by 50per cent in Uganda. The country has a total road network of about 65,700 km (35,700 km excluding community roads), of which 8per cent (excluding community roads) of the road network is paved, 47per cent is gravel roads and 45per cent is earth roads. Road infrastructure provides a significant platform to allow overall productivity and development of the country's economy. It is estimated that the inadequate physical road connectivity, possibly constrains GDP growth up to 2 percentage points a year. More to that, about 123.8 of poor people would be raised above the poverty line for each $0.02 million of additional investment in roads, given her contribution to growth of agricultural production. With proper road infrastructure that's congestion free, trucks on delivery schedules can travel an excess of 100KM to 200KM, Sharma and Vohra [6]. It's probably because of this that Uganda dedicated 12per cent of the national budget (2011/2012) to the development and maintenance of the road networks, Nassasira [2]. Many developing countries road design and standards originate from what was required decades ago for a different mix of traffic and vehicles that are not applicable to date. This calls for up grading of

safety features for the vulnerable road users like pedestrian crossing facilities, providing for motorcycle lanes and islands for pedestrians and cyclists, signs and markings, low speed zones, crossings, intersections, roundabouts, parking facilities, speed humps, lighting of the road, reflectivity of signs and markings, among others as the traffic population grows, Flahaut [7]. Driver compliance is about the perceptions and attitudes of drivers towards the level of accident risk in the driving environment (Vehicle and Road Infrastructure) and the effectiveness of safety regulation enforcement, Douglas and Swartz [8]; Wilde [3]. These authors agree that voluntary compliance is easier to achieve as opposed to mandatory compliance on highways. Following Thompson et al [9] in their study on self regulation initiative in heavy vehicle transport, there is evidence from the Load Accreditation Programme that is based on the National Heavy Vehicle Accreditation Scheme (NHVAS) practised in Australia, that the incidence of prosecutable vehicle overloading in the timber industry alone reduced by 40 and 45per cent in a space of one year. This self regulation scheme has attracted attention due to the support from governments and the incentives extended to transporters that include: limiting the weighing of accredited operators, discounts on vehicle insurance premiums and discounts on toll fees, Thompson et al [9]. Key to note is that, regardless of whether it is voluntary or mandatory, there must be some level of enforcement and factors such as road infrastructure will still influence the perceptions and attitudes of drivers when making compliance decisions.Studies in line with driver compliance undertaken by Friday et al [10] and Mawanga and Ntayi [11] point to safety regulation enforcement and social norms as the reasons for the deteriorating driver behaviours. However, scholars from different countries like Mutto et al [4], reveal that road infrastructure has a key role in improving compliance to safety regulations. This study is keen on establishing how road infrastructure can improve the driver compliance on Ugandan roads in order to reduce the number of accidents. Other parts of the paper include; the literature review, methodology, presentation and discussion of findings, research limitations and the related implications of the study. Reference is also made to the Risk Homeostasis Theory by Wilde [3] on how it relates with road infrastructure improvements and driver compliance.

Literature Review

Compliance is defined by search data management [12] as either a state of being in accordance with established guidelines or legislation, or the process of becoming so. Road safety on in Uganda is achievable by ensuring driver compliance through enforcement of the road safety regulations provided for in the Traffic and Road Safety Act, Friday et al [10]. Besides enforcement, scholars like Mutto et al [4] reveal that road infrastructure plays a significant role in improving driver compliance. Driver compliance according to Douglas and Swartz [8] and Wilde [3], is about perceptions and attitudes of drivers towards the possibility of getting involved in an accident based on the driving environment (Vehicle and Road Infrastructure). A study done by Mawanga and Ntayi [11] on driver compliance in Uganda concluded that it is through understanding social norms that compliance can be achieved. Given that compliance has a lot to do with perception and behaviour, it becomes difficult to predict whether drivers will voluntarily comply without any form of mandatory enforcement. Studies by Douglas and Swartz [8] and Wilde [3] reveal that voluntary compliance as opposed to mandatory compliance should be targeted in the bid to improve road safety. But the argument would be, for example where voluntary compliance suggested under the National Heavy Vehicle Accreditation Scheme (NHVAS) Thompson et al [9] is considered, should there be no form of intervention at all through road infrastructure improvement and maintenance or from safety regulation enforcers? How is it possible that consignors and consignees of shipments using heavy tracks can be left to entirely regulate themselves without any form of intervention, as a way of promoting voluntary compliance? Unlike the western countries where road infrastructure is fully developed, it would be best that roads be fully developed and standardised in Uganda and then studies on voluntary compliance would become relevant. Otherwise, drivers in the country have always given excuses of non existing road signs, dark streets, among others to get away with traffic law offences. Road Infrastructure comprises of public utilities and public works, roads, bridges, street lights, signage, road markings, transport communication technologies, among others. The delivery of road infrastructure services in general for African countries lies within market structures where competition is absent and often provided by centrally managed bureaucratic government departments or agencies that luck the competitive urge to push for efficiencies. With the advancement in technology, increase in awareness of the necessity for a larger private sector role in infrastructure delivery and management and greater concern for

environmental sustainability; have provided an impetus for road infrastructure reform. This explains the increasing appreciation of infrastructure development strategies like Public Private Partnerships (PPP) where strategies like Build Operate Own (BOO) and Build Operate and Transfer (BOT) among others have been applied to achieve efficiencies, Luiz [13]. It should be noted that, the inadequacy of the road infrastructure in terms of proper road signage, traffic lights, port holes among others, have forced drivers to drive on wrong roads and directions, over speed or drive below speed limits leading to non compliance to safety regulations.The Ugandan government has taken measures to improve road standards by allotting more funds towards road construction and also through road safety audits for both new and existing roads, identification and reconstruction of black spots like those on the Mbarara-Masaka Kampala highway, reinstallation of road signs and painting road markings, Nasasira [2]. The UN working with government also recommended that 10% of the road investment projects should be dedicated to safety rating and infrastructure improvements like safety barriers, motor cycle lanes, pedestrian facilities among others Robertson et al [14]. These interventions are meant to improve road infrastructure and increase on road safety by reducing the possibility of accident occurrences. Road accidents include any vehicle accident occurring on a public highway or road that is; originating on, terminating on, or involving a vehicle partially on the highway. These accidents include; collisions between vehicles and animals, vehicles and pedestrians, vehicles and cyclists, or vehicles and fixed obstacles. Human error, usually a result of bad driver behaviour, Friday et al [10]; Mawanga and Ntayi [11], accounts for about 80 to 95per cent of the road traffic crashes. These behaviours; reckless driving, over speeding, inconsiderate use of the road, incompetent drivers and driving under the influence of alcohol or drugs, are indicators of non compliance to the safety regulations, Baguley and Jacobs [1]; Nassasira [2].The Road conditions in Uganda account for about 5per cent of all the road accidents being a result of; bad road surface, pot holes, poor road designs and inadequate road furniture. To show cause, 12per cent of the country's national budget was committed to the development and maintenance of the road network through construction of new roads like the Kabale – Kisoro highway and rehabilitation of old ones to improve on the efficiency and safety of road transport in Uganda. Other programmes like Road markings and signage to increase compliance to speed limits, improving on the "black spots" along major road corridors have been put in place, Mawanga and Ntayi [11]; Nasasira [2]. To solve the road infrastructure problem, there is a need for a radically different approach to the geometric design of highways for developing countries like Uganda, especially for low volume roads. Studies of the relationships between geometric design and road accidents in Kenya, Jamaica, Chile and India indicated that junctions per kilometre were the most significant factors relating to accidents, followed by horizontal and vertical curvature, Baguley and Jacobs [1]. On the other hand, Baguley and Jacobs [1] think that countries like Uganda with relatively low levels of road-user discipline are less likely to have success in increasing driver compliance to safety regulations with very low-cost measures such as road signs and markings. This is seen from driver's lack of respect for stop lines and lane lines at junctions and no overtaking lines at bends or traffic lights, let alone driving and parking on pavements.Among the major contributors to road infrastructure destruction is non compliance by drivers to designed load weights on the roads. This does not only damage the road, but exposes other road users to accidents, burdens the tax payer and also allows unfair competition in the transport industry, Taylor et al [15]. During his study in Virginia and Idaho, it was discovered that 14per cent of truck operators avoid weigh stations by using an alternative route even when it was open. It was also established that operators would travel up to 160 miles to avoid a weigh station. The Virginia study also documented the practice of weigh station running or plugging, where drivers purposely convoy large numbers of trucks in order to exceed the ramp capacity of the station. Overloaded and heavier vehicles travel at the rear of the convoys, with the intent of bypassing the facility when the ramps are filled, and the station is temporarily closed. These behaviours exhibited by drivers who purposely evade compliance to load weight regulations are what Douglas and Swartz [8] and Friday et al [10] categorised under the perceived regulatory enforcement. Unfortunately, Uganda has not gotten to the level of implementing such strategies as adoption of the Weight in Motion methods to weigh vehicles on the roads and ensure compliance, as suggested by the scholar.Wilde [3], on the other hand providing evidence on the Risk homoeostasis theory reveals that, as safety features are added to roads and vehicles, drivers tend to increase their exposure to collision risk because they feel better protected. In support, there is evidence showing an increase in the number of traffic crashes and pedestrian

injuries recorded after an overpass was constructed for a busy suburb of Nakawa on the Kampala – Jinja highway. This statement however, rises need to establish whether not doing anything at all about road infrastructure modification could decrease the bad road behaviour and therefore increase driver compliance because of the high perceived risk to crash created by the poor road condition. Friday et al [10] and Leon and Barry [16] do not seem to agree as they see this as an excuse for doing nothing to improve the compliance levels. It is worthwhile to suggest that good road infrastructure would imply compliance to safety regulatory enforcement through; control of speed by use of speed humps, road blocks to avoid collusion on rail intersections, keeping to the right lane because there no pot holes, proper lighting to allow for legibility of road signs, etc. Furthermore, the increase in accidents after road infrastructure improvement could be explained by the lack of adequate measures to enforce safety regulations as opposed to the road modifications, Mutto et al [4]; Wilde [3]. Friday [10] and Green [17] though focusing on different aspects shared a common objective on improving road safety through driver compliance by applying vehicle telematics. Green argues that the increasing development of Information Transport Systems/Vehicle telematics without relative support from safety regulations or the enforcers, has increased the work load of drivers causing both visual and mind set distractions and therefore reducing the level of driver compliance behind the wheel. That driver information systems require drivers to look away from the road, to operate controls, to speak to, or even just listen to them. Performance of these tasks can distract drivers from the primary task of driving and lead to crashes. But he agrees that Navigation systems allow drivers to travel to unknown destinations in safety, avoiding the need to refer to paper maps and other materials. Mobile phones provide rapid access to police and emergency services, allowing them to reach crash scenes quickly and save lives. Email, web access, traffic information, and other systems will provide useful information to drivers in a timely manner. The point is not that these devices in themselves are bad, but that when used at particular times and for certain tasks, they present an unacceptable risk to the motoring public by overloading drivers. Besides applying and extending driver interface regulations and design guidelines, for example from phone use to navigation systems, the relevance of his findings to this study is in his contribution of designing driver and road interface systems based on driver centeredness. For example, Manufacturers and regulators should be able to develop information regulation systems that can detect the less need for the drivers attention to driving and therefore allow him to interface with the devices, for example when driving on inter-state highways that have less bends, are wide, more signage and with less traffic congestion. This argument supports Wever et al [18]'s revelation that driver compliance can be where the adopted designs, whether for the car products or road infrastructure, are developed using a user centred design.By accepting the adoption of Information Transport Systems (ITS) to improve road safety, Green [17] seems to disagree with Wilde [2] on the Risk Homeostasis Theory. Wilde argues that as electronic safety features (vehicle telematics) are added to vehicles (vehicle telematics) or embedded in the road infrastructure, Friday [1], drivers tend to increase their exposure to collision risk because they are aware of the accident risk and therefore build the confidence of being able to manage the situation. The theory refers to this as Sub-optimal risk taking which occurs if the driver underestimates or over-estimates the danger of a given activity, because that person would either take too much risk or too little for greatest net benefit. Their arguments might agree on the fact that telematics can increase the rate of accident exposure, but that is if they are not regulated. The argument against the Risk Homeostasis Theory is further supported by Leon and Barry [16] who indicated that 90per cent of the reduction in road crashes is due to road and vehicle modifications and that following the homoeostasis theory would only worsen the situation. The issue of driver compliance has a lot to do with how drivers perceive the likely risk of getting involved in a road crash as purported by Peltzman with his proposed theory of "risk compensation in 1975, and Wilde [3]'s Risk Homeostasis Theory. From these theories, drivers are likely to take on more risk by for example, driving faster than the required speed because of the road safety improvements on the road. In a study undertaken by Thompson et al [9] on Risk Compensation and Bicycle helmets, the findings showed that helmets actually reduce on the fatality of head injuries during accidents. Following the risk compensation theory, this would imply that cyclists will take on more risk on the road because they feel safe. The authors argue that regardless of how the cyclist feels safe and chooses to take more risk, it remains that the helmet will keep them safe at that particular moment. That if it were for speed, the cyclist would have to take on the risk fourfold for the helmet to seize offering safety, which is never the case. The argument would be the same for road

infrastructure improvement; drivers will not drive at four times the speed they are supposed to drive just because there is a better road. Walker et al [19] however seem to agree with the theories based on the findings from their Unsafe driving behaviour and four wheel drive vehicles study. It was established that the level of non-compliance with the law on the use of hand held mobile phones and the use of seat belts by drivers of four wheel drives was higher when compared to the normal vehicles. Lee [20] reveals that older populations (About 60years and above) in the more developed countries are found to be more conscious to compliance where the road infrastructure is standardized. His study shows that elderly drivers prefer not to overtake, drive slowly and stay in one lane. Even with the increased toll of age on sight and body responsiveness, the chances that those driving behaviours will expose other road users to accidents is minimal. The challenge with this study's relevance to the Ugandan scenario is on the difference in life expectancy basing on where the study was done. While current studies show that twenty percent of the population in developed nations are aged 60 or older, with one out of three persons likely to exceed 60 years of age by 2050, this is not so in this country where the life expectancy is 54.33years (Male) and 52.17 years (Female) as revealed on the index mundi website [21]. However, what is important to note is that, standardized road infrastructure will allow all those who make it past the life expectancy to drive in compliance with the stated safety regulations.In conclusion, the literature reviewed indicates that compliance has more to do with the drivers' perception on the risk of getting involved in an accident than social norms, road infrastructure development or level of road safety regulation enforcement as suggest by previous studies. Regardless of how much the Risk Compensation theory, Risk Homeostasis Theory and all the other theories that relate to them are criticized, these theories make a significant contribution towards understanding why drivers decide not to comply with the road safety regulations. The standardisation of road infrastructure by building wider roads with visible signage and lanes, traffic lights, automatic cross road blockers, weighing bridges and embedment of the best Information Transport System, cannot in its own way lead to 100percent driver compliance. Driver compliance whether mandatory or voluntary can only be achieved with a combination of forces with road infrastructure being one of them. While aspects like safety regulation enforcement and road infrastructure can be physically improved, the challenge is on how to influence the perception of drivers to work within the stated regulations given the fact that there are high chances of becoming non compliant every time road safety measures are improved. A good example is the common behaviour for drivers, whether in four wheel drives or normal cars, to speed up every time they notice clear roads. The lesson taken from the considered theories above is that it can be worse if nothing is done at all to improve road safety by modifying the road infrastructure for fear of influencing drivers to take on higher risks.

Methodology

A cross sectional approach to the study was adopted to overcome funding and time constraints. A correlation survey research design was applied to establish the relationship between the variables. Trained traffic police officers on highways in the different regions of the country (Uganda) constituted the focus of this study. A total of 1094 traffic officers Batalia [22] were targeted as the study population. Simple random sampling technique was used to allow an equal probability for all the members to be represented in the select respondents. Using the Krejice and Morgan [23] table to determine the sample, a total of 285 respondents was selected to comprise the sample for the study. The questionnaire was developed and pretested through a Confirmatory Factor Analysis (CFA) to assess the validity of each construct in the model while the reliability of the variables was assessed basing on Cronbach [24]. A total of 118 questionnaires were returned making an acceptable response rate of 41.4 per cent, Biersdorff [25].The questionnaire was self administered by respondents who selected a suitable number on the Likert scale; ranging from SD=1 Strongly Disagree to SA=5 Strongly Agree, as a response measure of their perception on the given variables. The structured questionnaire measured Road Infrastructure using Mutto et al [4]'s constructs while driver compliance was measured using constructs developed from Mawanga and Ntayi [11]. For ethical research reasons, Research Assistants were given a general introduction letter from Makerere University Business School that was presented to the Commissioner Traffics' office as proof that the intentions of the study were strictly academic and that the findings would only used for the later. It should also be noted that the questionnaire was reviewed by the Commissioner Traffic's office to ensure that the data to be collected would not compromise the security operations of the traffic police. For each respondent, consent was also sought by the questionnaire administrators in charge before handing over the questionnaire to

be self administered. The respondents were asked to sign the questionnaire trucking sheet but not to include any information that would identify them on the questionnaire. Quantitative data analysis was carried out using a Statistical Package for Social Scientists (SPSS) to establish the correlation between the variables and a correlation coefficient was run to establish the

Table 2:Showing the regression analysis summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.485[a]	.236	.229	.40045

a. Predictors: (Constant), Road infrastructure

direction and strength of the relationships between variables. A regression analysis was carried out to determine the predictive strength of the independent variables on the dependent variable. From the results, inferences on road infrastructure and driver compliance were made.

Discussion of Findings

The following discussion and inferences are based on a 41.4per cent response rate which though low is acceptable, Biersdorff [25]. The personal characteristics of the respondents indicate that the study was dominated by male traffic officers (74.4per cent), with the dominant age group being 25 to 35 years (48.7per cent). Most traffic officers had a certificate as their highest academic qualification (62.1per cent), with the majority earning below Shs.400, 000 Uganda shillings (94per cent). The study captured more field officers (71.3per cent) than middle level managers (28.7per cent) and no high level manager with majority having worked in the force for over 8years (48.3per cent). Likewise, most of the traffic officers that took part in the study were from the central region (63.6 per cent). It should be noted; the fact that no high level manager participated in this survey could have denied the study an insight into the strategic focus of the traffic force on driver compliance.

Correlation Analysis

A correlation analysis was done to determine the strength and direction of the relationships between the independent variables and driver compliance (Refer to table 4.1). The results revealed that there is a positive significant relationship between road infrastructure and driver compliance, (Sig. p<.000).

Regression Analysis

Reference to table 4.2 shows that road infrastructure can predict up to 23.6per cent of the change in driver compliance, (Beta = .485, p<.01). The model was robust (Sig. F<.01), in that

Table 1:Showing the correlation analysis

		Road infrastructure	Driver compliance
Road infrastructure	Pearson Correlation	1	.485**
	Sig. (2-tailed)		.000
	N	118	117
Driver compliance	Pearson Correlation	.485**	1
	Sig. (2-tailed)	.000	
	N	117	117

**. Correlation is significant at the 0.01 level (2-tailed).

the independent variable in the model was found to be a good predictor of driver compliance.

Research Implications

From the literature reviewed, it would be prudent to infer that social norms, Mawanga and Ntayi [11] and the related driver attitudes, Douglas and Swartz [8] and perceptions, Wilde, [3] are the main factors that influence driver compliance. Friday et al [10] in their study on safety regulation enforcement, though in agreement with the later, contributed by establishing road safety regulation enforcement as the other factor that influences mandatory driver compliance. Following suite, this study disclosed a 22.9per cent predication ability of road infrastructure on driver compliance. We can therefore state that improving of road infrastructure in Uganda will have a significant positive influence on the levels of driver compliance. Implying that the removal of black spots, potholes, marking of lanes, adequate signage, automatic blocks on rail crossing, street lights, and building of pavements for pedestrians would result into higher levels of driver compliance and an overall increase in road safety. The initiative by the Ugandan government with support from the UN to improve road standards by allotting more funds towards road construction, road safety audits for both new and existing roads, identification and reconstruction of black spots like those on the Mbarara - Masaka Kampala highway, reinstallation of road signs and painting road markings, Nasasira [2]; Robertson et al [14] etc, are measures that will lead to improvement in driver compliance and therefore reduce the number of accidents. The literature reviewed supported Douglas and Swartz [8] and Wilde [4]'s findings on driver attitudes and perceptions as the main factors influencing driver compliance. The finding from this study, though in agreement to an extent also confirm that other factors like road infrastructure too have a significant contribution towards improving driver compliance. However, it is also possible to infer that using attitudes and perceptions could allow faster influence on

achieving voluntary compliance. But, factors like road safety regulation enforcement, Friday et al [10] and modernised road infrastructure will help achieve mandatory compliance. Referring back to the risk homeostasis theory, the findings in this study relate with the theory at two fronts; firstly, that driver compliance is highly influenced by attitudes and perceptions given that drivers can still choose not to comply even with standardised road infrastructure. Secondly, given that there is a positive significant relationship between road infrastructure and driver compliance, it is acceptable to infer that standardised roads will improve the driver's attitudes and perceptions in a positive way and therefore increase on the level of compliance. The point of departure from the risk homeostasis theory is where it seems to imply that doing nothing at all about improving safety measures will increase the driver's perception of risk and therefore cause them to take on less risk for fear of crashing and thereby, complying to safety regulations. Mutto et al [4], Friday et al [10] and the findings from this study confirm interventions, whether through road safety enforcement or modernisation of the road infrastructure will increase driver compliance. Considering Lee [20]'s study on elderly populations, its agreeable to state that some elderly drivers are voluntarily willing to comply to provided road safety regulations without any form of enforcement. However, they face a challenge of impairment to sight or quick reflex due to old age. Given that road infrastructure has a positive relationship with driver compliance, we can conclude by saying that standardised road infrastructure will facilitate further compliance of drivers who are either risk averse or are willingly ready to comply. Unfortunately his study was carried out in developed nations whose populations' expectations are that one out of every three persons is likely to exceed 60 years of age by 2050, this is not so in this country where the life expectancy is 54.33years (Male) and 52.17 years (Female). As opposed to the western countries, Uganda's population is categorised as such that majority of the people will still be below 60years. Given that the road infrastructure is not standardised, both the young drivers characterised with driving at high speeds, overtaking, switching lanes, driving under alcohol or drug abuse, will share the same lanes with the few old drivers who are more conscious and compliant. Managing this chaos will require government to modernise and standardise the available roads to cater for the different categorises of drivers. Combining these driving behaviours on single lane roads as is today will definitely expose road users to high accident risks.

Policy Implications and Recommendations

Many developing countries including Uganda, have drawn very beautify policies either from within or with the support of international organisations like the UN, IMF and World Bank. But if not left on paper, most of the recommended policies have failed to achieve their intended objective due either inadequate funding or poor implementation. To start with, the government needs to adopt new technologies by utilizing technology designed for the commercial vehicle information systems and road networks, Friday et al [10]; Taylor et al [15]. For example, by deployment of fully automated weigh station facilities at high volume, high cost facilities like at the country borders, heavy truck drivers avoiding weighing bridges will be managed with ease. Such automated weighing bridges on highways would definitely lead to an increased compliance by heavy truck drivers to the road weight limits. Further automation of road blocks and road toll points coupled with cameras and electronic detectors embedded under the road surfaces, all as part of modernisation and standardisation of road infrastructure, would lead to an improvement in driver compliance. Borrowing from Wever et al [18], the government should study the driver behaviours for guidance during the design of road infrastructure based on these findings. This strategy also referred to as the 'user-centred design' will help the country achieve sustainability of set driver compliance levels. Using an example of car designs today that make it impossible to lock the driver-seat door from the outside without using the key, to prevent drivers from leaving the car keys inside, road infrastructure developments like construction of high pavements that cannot easily be climbed by cars, automatic blocks on rail crossings, in built speed governors, among other client centred designs can be applied to improve driver compliance on roads in Uganda.In conclusion, the government of Uganda seems to understand the need for good road infrastructure and is going ahead to allocate significant percentages of the financial budgets to developing roads. However, there is need to revisit the policies that will oversee the implementation of the road constructions and improvements. Where convenient, laws on the application of information technology should be given priority to speed the efforts in improving driver compliance on the roads in the country. Information technologies will see the traffic force transition from the traditional approaches currently under use to

more efficient driver compliance enforcement techniques that are also less costly. Strategies such as public private partnerships (PPPs) can be adopted on profitable highways like the Kampala (capital city) – Entebbe (Airport) highway to relieve the government from spending scarce resources. Policies on standard road radius and how far people construct from roads when developing private property should be made clear and brought to the awareness of the citizens. These will pre-empt the conflicts in regard to relocating people and disagreements on compensations that stall road construction and expansion plans.

Research Challenges and Limitations

Unfortunately, all researchers usually face similar challengers when undertaking studies of an empirical nature. The uniqueness of the limitations are majorly dictated by the different variables under study, the nature of respondents or the geography and time scope among other factors. It is therefore likely that the research challenges for this study are unique because the study was carried out in Uganda with traffic officers as the respondents. Key to note was the difficulty of accessing the respondents for feedback given the sensitivity and nature of their profession. The traffic force in Uganda are part of the security arm of government, implying limitations on how much the researcher could access in terms of the respondents and the amount of information as some of it is classified. However, with support from the Commissioner Traffic's office, the researcher was able to successfully carry out the study with minor interferences. The other area of concern arises from the suspicion as to whether the respondents squarely conceptualised the kind of road infrastructure modernisation that the study focused on given their level of training and exposure and the fact that none of the high level managers in the traffic force participated in the study. It is possible to state that majority of the respondents' knowledge on weighing bridges, speed detectors, automated road blocks on rail crossings, more than three lane roads and flyovers, are some of the aspects not common to the traffic officers and this could have biased their responses. To overcome this, the researchers made it a point to simplify the language in the questionnaire to suit the respondents' level of understanding in order to get the desired response. Information asymmetry on road infrastructure and compliance in Uganda proved a big challenge as there have not been that many pragmatic studies done in these areas. This challenge was addressed by reviewing relevant literature from studies done in the more developed countries like Australia and the USA and the available local studies on road infrastructure and driver compliance.

Areas for Future Research

Driver compliance is a very pertinent issue in respect to improving road safety on roads in Uganda. While road infrastructure did show a significant contribution towards its achievement, the researcher identified a gap during the study relating to Voluntary Verses Mandatory driver compliance that should be addressed by future researchers. For example, the findings of this study could not specifically tell whether road infrastructure increases voluntary or mandatory driver compliance. More to that, much as the researcher suggests the changing of the target respondents from traffic law enforcers to drivers, it is also important that different studies are done on the various categories of drivers. For example, Golob and Hensher [28] reveal that truck drivers on national highways are the biggest causers of road accidents as compared to other road users due to none compliance to weight load limits, extended hours behind the wheel, among others. A study can therefore be carried out clearly categorising the different drivers' compliance levels and how they contribute to the increasing rate of the road accident scourge. The other contribution would be in establishing other variables besides road infrastructure, safety regulation enforcement or social norms that can improve driver compliance. Studies show safety awareness and road communication technologies as some of the other variables that can have a positive influence on driver compliance. Issues to do with self regulation Nordengen [29] and user centred designs Eibl [30] for road infrastructure modifications can also be studied in the bid to achieve voluntary driver compliance.

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