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Determinants of Road Traffic Accidents in Kenya

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Abstract

Road traffic accidents are on the increase despite interventions implemented by states, stakeholders and partners. World Health Organization (2018) has reported that more than 1.35 million people die every year on the world's roads, making road traffic injuries a leading cause of death globally. Most of these deaths occur in low- and middle-income countries where rapid economic growth has been witnessed in recent years, in spite of COVID 19 pandemic, which interfered with global health and economies. In Kenya 3500 people die each year due to road crashes, while nearly 1000 are left with life threatening disabilities.

The purpose of this study was: To investigate major determinants that are associated with road traffic accidents which have also been identified by other researchers that have directly or indirectly contributed to accidents causation both in developed and in developing countries, particularly in Asia and Africa including Kenya. A systematic review was used to review the most current researches that have been conducted on road traffic accidents that caused deaths and injuries to significant road users. Literature search was conducted, using Google-scholar and Pub med. The review used 58 most current studies from a total of 120.

The study findings: Revealed that there is an increase in the number of vehicles praying on the roads, coupled with an increase of population and especially those using vehicles, and motorcycles. Intentional violation of traffic rules was reported. Poor implementation of road safety network, poor planning and design of road infrastructures were identified. Poor mechanical conditions of vehicles, over speeding, overloading, uncontrolled and mixed traffic environment were equally cited. Again, road "users" and drivers' behavior, have significantly contributed to the increase of road traffic accidents, contributing to mortalities and morbidities. The commonly affected people are pedestrians and passengers who are between 15-29 years of age.

Conclusion: Factors contributing to accidents causation include; increased vehicles and vehicular use and human factor leading to intentional violation of traffic rules; bad roads, over-speeding and over-loading was identified to be associated with road traffic accidents. Likewise, use of unroadworthy vehicles, errors of other significant road users, poor implementation of road safety measures and poor planning and design of road infrastructures were also identified.

Recommendations: Sustainable road safety to be based on individual road user's decision, geared towards personal responsibility, tailoring traffic environment to human characteristics by training and education, improving road network, control of speed, direction and mass to vulnerable road users.

Keywords: road traffic accidents; traffic injuries; morbidities and mortalities; sustainable safety

Introduction

More than 1.35 million people die every year on the world's roads, making road traffic injuries a leading cause of death globally. Most of these deaths occur in low- and middle-income countries where rapid economic growth has been witnessed in recent years. Unfortunately, this has been accompanied by increased motorization and road traffic injuries (WHO, 2018). Again, this economic gain has been derailed by Covid-19 pandemic. As well as being a public health problem, road traffic injuries are a socio-economic and development issue. It is estimated that low- and middle-income countries lose approximately 3% of their GDP because of road traffic crashes. Road traffic injuries are the number one cause of death among those aged 15-29 years. These group of people are considered economically productive and in their active reproductive period. The loss of this group is deemed a disaster to the country's development (Sapkota et al., 2016; Macharia et al., 2009). Road traffic injuries are currently estimated to be the ninth leading cause of death across all age groups globally, and are predicted to become the seventh leading cause of death by 2030 (Global Status Report on Road Safety, 2015 by World Health Organization). Fundamentally, the major reasons for the escalating death toll on the roads in low- and middle-income countries-particularly in emerging economies is due to urbanization and motorization accompanied by rapid economic growth. However, in many of these countries, there is glaring lack of the necessary infrastructural development and policy formulation and implementation as well as levels of enforcement that have not kept pace with vehicle use. In contrast, many developed countries have managed to break the link between rising motorization and road traffic deaths, with some managing to dramatically reduce such deaths. These achievements are the result of making infrastructure safer, improving the safety of vehicles, and implementing a number of other interventions known to be effective at reducing road traffic injuries (WHO, 2015).

The increase in mobility is absolutely necessary and has brought many benefits. Unfortunately, it has also resulted into loss of precious human lives and damage to the vehicles along with properties during collision on the roads. The statistics are disheartening, WHO (2018) reported that some 1.35 million people are killed on the world's roads, in addition with millions more injured, many seriously who are left with life-threatening disabilities. The report continues to reveal that there is an imbalance between the number of registered vehicles per 1,000 people and the rate of deaths per 100,000 in African region as compared to the world. This shows that Africa region has the highest death rate with more than 26 per 100.000 populations. In developed countries with high motorization, has the lowest rate of accidents with less than 50 per 1000 people.

This scenario calls for concerted efforts to stem these man-made disastrous epidemics. The impact of road traffic accident in term of injuries, impairments and fatalities are global socio-economic and public health problems. It is now well established that many developing countries face a serious and double tragedy of communicable diseases and the problem of road accidents.

Methodology

Literature search was conducted, using Google-scholar and pub med. One hundred and twenty scientific studies published from 1990 through 2021 were reviewed. Of these, 58 met the study requirements to be included in the final review.

Result

The search revealed the following findings; there is an increase in the number of vehicles praying on the roads, coupled with an increase of population and especially those using vehicles, and motorcycles. Again, some vehicles are in poor mechanical conditions,

and roads are in poor conditions as evidenced by lack of proper road maintenance and infrastructures, lack of political commitment, in terms of policy formulation, implementation and leadership. This is particularly evident in low income-countries. Governance and resource mobilization are lacking. Drivers' behavior, lack of proper driving skills and experience and intentional violation of traffic rules are significantly associated with increase of road traffic accidents. This has indeed increased injuries, contributing to mortalities and morbidities globally and particularly in developing countries including Kenya. However, these causes have been narrowed down to six major thematic areas; road users' behavior, challenges of road policy framework and implementation, drivers' etiquette and unethical conduct of behavior and skills, mechanical condition of the vehicles, lack of road infrastructures, uncontrolled and mixed traffic environment. These are all determinants to accident causation. All these contributes to the determinants of road traffic accidents. Table 01; shows the reported occurrence frequencies by researches.

Thematic areas	***Number cited***	***Percentages***
Road user's behavior (human factor)	12	20.7
Challenges in Road policy frame-work implementation	8	13.8
Drivers' etiquette, behavior and skills.	12	20.7
Mechanical condition of vehicle.	6	10.34
Lack of road infrastructures.	7	12.06
Uncontrolled and mixed traffic	13	22.4
Grand Total	58	100

Table 1: Result of frequencies of causes cited from researches.

Implications

Accident fatalities rate in developing countries are high in comparison with those in developed countries. The most vulnerable road users are; pedestrians, cyclists and riders of motorbikes and their passengers accounting for staggering 46% of global traffic deaths (WHO, 2009; WHO, 2015; WHO, 2018). In Kenya, road traffic accidents are responsible for causing a fatality rate of 3500 people annually (Traffic Police Report, 2015). This is the official record; however, there are those who are never reported as well as those who are left with life threatening injuries and minor injuries in the backyard. It has become a tradition that every time an accident occurs, there is the usual outcry from all quarters that drivers must be carefully when driving on the roads to avoid unnecessary and preventable loss of human lives. The situation is made worse with multi-factorial increase of traffic amidst of mixed traffic, which complicates the prevailing situation. The vehicles' population increases every year, coupled with mixed traffic situation, this creates a major social problem- the loss of lives through road accidents. Increase in traffic brings out extremely severe problem of road accidents. Again, the sudden economic growth in Kenya, beside derailment of COVID-19 pandemic, in recent decades has led to a stunning growth in vehicle population, which is easily a contributory factor responsible for an alarming increase in the incidence of road traffic accidents in the country. The congestion of people, and increased numbers of motor vehicles, and poor road network, which is accompanied by consequent traffic accidents leads to loss of lives and property. Road traffic accidents in Kenya is basically a public health, economic and social problem, a burden and loss implied to the country, making Kenya one of the worst affected countries in the world with respect to traffic accidents and injuries that has led to the deaths of more than 3500 people every year. If the government and the people do not take appropriate and effective steps of reducing road traffic accidents now, the dramatic rates of increase is estimated to lead to the deaths of 4,500 people per year in the coming years. It is worth noting that apart from loss of life, the emotional turmoil and orphan dilemma; there is the financial implication that RTAs places on these developing economies which is far worse than acceptable. Again, studies have estimated that a country loses between 1.3 to 3% of its gross domestic product (GDP) to RTAs (Manyara, 2016). It is under this background that, there is an urgent need to employ concerted strategies to combat the menace through public sensitization, proper policy formulation and or traffic law enforcement as well as road infrastructural development.

Every year, there is a disaster that is not perceived as a disaster, involving more than 3,500 people dying as a result of Road Traffic Accident Deaths (RTADs) and yet it does not get the attention or response that is commensurate with a disaster. One crash with one thousand people killed is a disaster; one thousand deaths in one thousand crashes are as many individual tragedies. Society seems to shrug it off as if all these anonymous deaths are just part of life. The risk of being killed in a road crash seems too abstract a concept to be worried about. However, it is a different story when a dead or a fatally injured person is a neighbor, a colleague, a good friend, a relative or your own child. Then there is great dismay about how this could possibly happen, and questions arise as to how this would have been prevented.

Discussion

Developing countries and particularly middle- and lower-income countries of the world including Kenya experiencing the burden of road traffic accidents should model on the Netherland success story. Some of the strategies they have implemented are cost-effective and do not need heavy financial investment such as inculcating an attitude of being responsible in not causing traffic accidents. Again, being conscious of the aftermath of an accident.

In Kenya, traffic accidents are a common occurrence. The country has experienced an increase in road traffic accidents every year, recording 3,500 deaths from 2015, being official figures, but many more are killed and not reported to the police due to numerous consequences. However, various parties (Kelly, 2019) have questioned the recorded numbers. Keeping reliable statistic records is extremely difficult amongst other competing activities. It is advisable that the country should copy the Netherland experience, which has worked very well which I will discuss in this paper. The strategies are cost-effective and implementable though the country is considered as a developing country ranked as lower income that has some limitations. However, it has lagged behind in road infrastructures, which are not consistent and in keeping with international road safety standards coupled with policy challenges. Current road fatality statistics are worrying. The country recorded 3,572 fatalities, 6,938 serious injuries and 5,186 slight injuries as at December 2019 as reported by the National Transport and Safety Authority (NTSA, 2020).

In 2022, 21760 people were involved in road accidents, 4,690 died while the rest were left with life changing injuries. However, 9,933 were seriously injured and 7,137 were slightly injured (NTSA, 2023). The NTSA is a body responsible for coordinating road transport activities in the country. The general explanation on this has to do with the methods adopted of collecting the data and its categorization. The NTSA seems to adopt a dead on the sport for fatality report. Again, no follow-up is done with receiving hospitals, which one of the seriously injured succumbed to death. This is contrary to international recommended standards of reporting, which considers road traffic deaths within a 30-day window period (OECD, 1080; WHO, 2015).

Road traffic crashes are ranked top-five cause of death for Kenyans between the ages of five and 70, and the leading killer of males aged 15-19. The Ministry of Health, the National Transport and Safety Authority (NTSA), the World Health Organization (WHO) and Bloomberg Philanthropies have launched a new national initiative to reduce deaths and serious injuries from road traffic crashes by strengthening laws, policies and actions that are proven to save lives.

"No deaths on our roads are ever acceptable, and road traffic crashes are a pressing public health issue that we are working hard to urgently resolve. The work with WHO and partners through the Bloomberg Philanthropies Initiative for Global Road Safety will be key to supporting our efforts to save lives and push forward progress." said Mrs. Agnes Odhiambo (2022), the NTSA Board Chair person.

The launch of the Bloomberg Philanthropies Initiative for Global Road Safety in Kenya comes as the government finalizes a new National Road Safety Action Plan that aims to halve deaths from crashes by 2030. The government, WHO, Bloomberg Philanthropies (2022) and other partners are meeting to define how the initiative can best support the New Road Safety Plan.

"Road crash deaths are a crisis that hides in plain sight. Stepping up action on road safety is vital, as on top of the tragic human toll, road safety touches on all our lives each day, including getting to work and to school. By strengthening laws, practices and bringing partners together, the Bloomberg Philanthropies Initiative is key to saving lives," said Dr Abdourahmane Diallo (2022), WHO Representative in Kenya.

Worldwide, road traffic crashes kill approximately 1.35 million people every year - more than two every minute - with more than nine in ten of all deaths occurring in low and middle-income countries. Road traffic crashes are the leading cause of death for children and young adults aged 5-29 globally. However, WHO estimates that crashes will cause another 13 million deaths and 500 million injuries around the world by 2030 if urgent action is not taken (WHO, 2020). It is reported, "Bloomberg Philanthropies is proud to partner with the Government of Kenya to strengthen road safety efforts that will save lives. We are committed to supporting proven road safety interventions that save lives," said Kelly Larson (2022), who leads Bloomberg Philanthropies' Initiative for Global Road Safety.

There have been more deaths from road accidents in 2021, compared to a similar period last year. A survey by the National Transport and Safety Authority (NTSA, 2021) revealed that there was an increase of 18.5 per cent in road fatalities as of November 30, 2021. Some 4,121 people had been killed in various accidents as of November 30 as compared to 3,478 who died in the same period in 2020. Of these, 1,413 were pedestrians. Some 1,231 died in the same period last year. The pedestrians killed were crossing various roads when they were hit by vehicles and motorcycles. Motorcyclist deaths rose by 25.33% to 381 up from 304, passengers' death stood at 137 up from 105 in 2021. Passengers' deaths likewise grew by 7.14% to 225 this year. In 2021, 142 drivers died on the road while 127 did so by May 2022. However, NTSA reported that the deaths were caused by; reckless driving, dangerous overtaking, drunk driving, drunk walking, drunk riding, and failure to use helmets among other issues. "They result from speeding, lane indiscipline, overloading, dangerous overtaking and crossing the road at undesignated areas". At the end of the year 2021, Kenya recorded 4,579 fatalities because of road traffic crashes with tens of thousands more seriously injured. As at 22nd May 2022, a total of 1,816 fatalities were recorded showing an increase by 9.2% compared to a similar period in the year 2021 (NTSA, 2022). The numbers are still rising and it is expected to surpass 5,000 by the end of 2023.

Determinants of Road Traffic Accidents

The causes of RTAs are multi-factorial, though at times they may appear combined or separate in many instances. However, this paper will attempt to discuss specific factors leading to accident causation, though a number of them are very much interrelated, and with good investigations, they can easily be discovered at the time of an accident regarding their linkages. Again, cost-effective interventions can be implemented to scale down the menace, and carnage on the roads.

Increase of registered vehicles

Studies have shown that increase of registered vehicles has significantly increased the number of road crashes particularly in low-income countries. For instance, in African region, the number of registered vehicles per 1,000 people and the rate of deaths per 100,000 people in the region compared to the world are high, thus more than 26 persons per 100,000. However, the lowest motorization is much less than 50 per 1,000 persons, particularly in developed countries. Again, the financial burden that road traffic accidents place on these weak developing economies is enormous and unacceptably high (WHO, 2016; WHO, 2018). This essentially shows that an increase in registered vehicles together with an equally increase in population; are determinants to road traffic accidents and deaths.

Human factor

The age of the driver is fundamentally critical in navigating the roads. The documented age of the driver, which is prone to accident causation, is between 20 to 40 years. This is an age with many intrigues that bedevil the young adult. They want to show the world that they are experienced drivers. The driver's behavior is equally critical in maintaining sanity and calmness on the traffic environment. However, some drivers exhibit dangerous behavior and violate traffic rules while driving on the roads; others use bad language to other road users; as they overtake them. Furthermore, some are often drunk and have drunken driving with recklessness. However, recklessness with substance abuse, overloading, and over-speeding is a determinant to accident causation. This leads to loss of lives, injuries, disabilities, and loss of property, not forgetting children left orphans and traumatic emotional turmoil, among family members (Osoro, Ng'ang'a and Yitambe, 2015). Again, drivers of trucks and trailers who travel over long distances carrying goods, suffer from fatigue and drowsiness resulting from lack of sleep while on the roads. This is one of the main risk factors for accident causation.

Reckless road users such as other drivers lack road etiquette and code of conduct, with unsafe driving. Pedestrians who have no walkway on the side of the road compete with vehicles therefore making them vulnerable to accidents. Motor-cycles drive with abandon, having no regard or code of behavior while using the roads, and cause accidents. It is reported in the Holy Bible that there were mad drivers in the Holy Land, during Biblical time; like "Jehu who drove chariots with high speed like mad (2 Kings 19-20)", however, luckily horses had brains and wouldn't drive to a ditch, pothole, a ravine, or towards other horses or a tree to cause an accident. However, today's drivers, drive horses in- form of vehicles made of iron and steel that do not have brains or eyes. They are willing to be driven anywhere, wherever a drunk, undisciplined reckless driver behind the wheel drives them.

Vehicular Factor

It is important for a driver of a personal or public service vehicle to ensure that the vehicle is driving is in good mechanical condition and again it is serviced regularly to maintain its roadworthiness. However, many of the vehicles involved in road accidents are found to be in poor mechanical condition thus unroadworthy, being neglected and not serviced regularly or not serviced at all, a determinant for RTA. Again, a number of public service vehicles, which are involved in accidents, are not fully ensured by motor vehicle insurance firms, either third party or comprehensive insurance cover. This means accident victims may not be compensated as required by the Insurance Policy Cover Act in the event of an accident. It is not tenable for an individual to know or leave alone to ask whether the vehicle is entering has an insurance cover by insurance firm. This mandate is left to the traffic police to check those details and ensure the vehicle meets other necessary traffic requirements. Sadly, the traffic police most often turn a blind eye to those details including whether the vehicle is being driven by a trained competent licensed driver or not. In some situation, traffic police officers are more interested in collecting bribes from the driver or the conductor of the public service vehicle instead of checking for the basic traffic requirements of the vehicle. It can be remembered in the 1980's during the late Minister of Transport; John Michuki's era, Road Traffic Accidents dropped by 40% as a result of implementation of "Traffic Rule" famously known as the "Michuki Traffic Rules". It must also be remembered that the minister had the necessary political support and commitment in succeeding policy implementation. Therefore, this said, the "Traffic Police Officers, and the 'Political will' is seriously lacking, which is critical in curbing road accidents". After Michuki's era, political support or commitment, and traffic rule enforcement by law enforcement agents have progressively become weak or laxy giving leeway to ruddy and careless drivers to cause road crashes that has increased every year, leading to loss of lives, disabilities, injuries and loss of property (Osoro, Ng'ang'a and Yitambe, 2015).

Traffic environment (road condition)

Some of our roads are well constructed though not to the international standards that befits them. However, they are not well maintained, others are poorly constructed, with equal measures of neglect with potholes and glaring cracks which make them dangerous to drive, even with a well-maintained vehicle with an experienced trained and competent driver such that it is risky and vulnerable to cause traffic crash. Some roads have no road markings or warning signs. They are conspicuously lacking in strategic places, such as; black-spots, zebra crossings, children crossings, slippery lanes, falling stones, animals crossing, passenger case-way, diversions, climbing lanes, school ahead, busy/market days etc. However, this is a recipe for traffic mix and accident causation.

Standard practice and acceptable good road engineering is lacking in many places. Even where black spots are identified or known to occur no immediate action is taken to rectify the prevailing situation. This has led to repeated traffic accidents so often, essentially scaling-up the number of fatalities. Again, murram roads are worse especially during rainy season with poor visibility, muddy and slippery environment. Traffic accidents continue unabated which would have been prevented if corrective measure had been implemented in record time.

Black spots (areas escalating road traffic crashes)

In Kenya, there are areas known as "Black spots" as per Kenya Police Service (2020) which include; *Eastern Region*: Nkubu-Embu-Konza junction; Mtito to Tsavo; Emali Simba to Kibwezi, Mlolong Nanyuki to Isiolo. *Central Region*: Kiganjo-Narumoru road, Kibirigwi-Sagana road, Limuru-Upland section, Kiambu Muthaiga- Makutano-Embu section. *Rift Valley Region*: Kinungi-Naivasha-Gilgil Toll

Station, Molo GSU to Salgaa, Salgaa to ADC Farm, Chepsir-Kipkelion junction, Endebes Eldoret Road. *Coast Region*: Tsavo-Maung-Voi junction, Wundanyi-Mwatate Road, Maktau-Taveta Road, Mazeras Miritini Road, Rabai Ribe Road and Kibarani-Changamwe Road. *Western Region*: Mbale- Vihiga Road, Kakamega- Chabakali Road, Kakamega Kisumu- Mumias Makunga Road, Bungoma- Eldoret-Chemoi, and Kitale- Webuye-Lugulu Road. *Nyanza Region*: Awasi- Ahero Road, Kiboswa, Kisumu Road, Daraja Mbili- Bondo junction, Oyugis- Katito Road, Ogembo-Nyanguso Road, Kisii-Daraja Mbili and Migori Township. *Nairobi Region*: Kasarani GSU Stretch, Westlands Museum- Kabete Way, Jogoo Road and Waiyaki Way. *North Eastern Region*: Garissa Madogo-KBC Station, Modogashe- Habaswein, Buna-Gurar, Bangale- Hola Road, and Ukasi-Bangale Road. These are risky (black spot) areas where traffic accidents are a commonplace occurrence and accident victims do not get immediate assistance that can save their lives. Fortunately, it is usually the by-standers, people of the area or passengers of the vehicle coming behind the one involved in accident who assist the injured. Such areas require vehicle restraint system as well as a well-equipped roving monitoring Traffic Police or NTSA team to provide immediate 'First Aid' attention in saving the lives of people and safe-guard property.

In curbing "Black spot Accident" areas, suitable key parameters can be used that have been found suitable in developed countries, although they may require some form of modification or adjustment. They include; vehicle restraint systems (VRS). However, these may be subjected to selecting the most suitable based on performance even though conditions are typically different. The parameters related to the consequences of an accident are used more often for the decision as to whether to install a VRS or not. However, there are basically a list of hazards that would necessitate the installation of a VRS to mitigate the danger. Conversely, parameters related to the likelihood of a given type of accident are used more often to determine the level of performance required from the VRS, since these include parameters such as percentage of heavy goods vehicles (La Torre et al., Transport Research Arena, 2014). For the most performance requirement in the most common VRS application (roadside barriers), it is factors such as the presence of structures and railways lines, the presence and proximity of bodies of water and non-deformable roadside obstacles, the average annual daily traffic and actual speeds and the presence of adverse road geometry which are most prominent. Whilst factors such as aesthetics and cost are considered in some national guidelines and standards, their frequency is low. Whilst the majority of the countries have guidelines and/or standards related to roadside and median barriers, there is generally limited guidance for other VRS systems such as crash cushions, transitions and motor protection system (MPS). The important consideration is placement of VRS that focuses on safety barriers. Information on terminals, transitions and attenuators is scarce. Most of the studies make comparative analyses on accident rate and severity on road segments before and after the placement of safety barriers. The major consideration is to focus on the effectiveness of the method in reducing accident rate and severity.

Road Traffic Rules

Road traffic rules are well stipulated and should be observed at all times, but individuals and society utterly ignore, abuse and violate them. The results are immediate and disastrous-road traffic injuries with loss of life, disabilities, and loss of properties. When Road Traffic Accidents (RTAs) occur, there is either "loss of life, life-threatening serious injuries, moderate and minor injuries to passengers, pedestrians, the driver or other road users". There is loss of properties pertaining to damaged vehicle. Individuals and society argue that this is a transport problem. It should be noted that this is indeed a public health, insurance and transport problem as well as a socio-economic loss. In terms of computation analysis, countries lose between 1.5 to 3% of their GDP because of RTAs. Both the dead and the injured with their relatives will use scarce resources for hospitalization and funeral expenses, besides, widows and orphans' care. Insurance firms and the Vehicle Company or owner will lose money or property in lieu of damaged vehicle.

There is no doubt that public service vehicles are needed to meet the increasing transport needs of diverse groups of people. However, in spite of their importance, they rarely observe safety standards (Manyara, 2016; Mogambi and Nyakeri, 2015). For instance, the public service vehicles (PSV) are legalized to carry between 8 to 60 passengers depending on the category of the vehicles (NTSA, 2018). The vehicles often ferry in excess passengers, in total disregard to the laid-out rules and recommendations for each category of vehicle. In the occurrence of a traffic accident, this increases the number of casualties and impacted people. Additionally, a PSV driver is paid on a per trip basis, driving on unmarked and unsigned roads, with dense traffic jams with another competing motorist plying

the same route. This causes these drivers to have a general aggressive tendency while driving any road in due course, violating the traffic rules.

Apart from buses and matatus, motorcycle transport has been on the increase in the country. Likewise, the Tuck Tuck—three-wheeled vehicles are on the rise, thus increasing injuries and fatalities among users (Murumba, 2017; Diaz Olvera et al., 2019; Wang et al., 2019; Soehodho, 2017). However, with an increase in motorization of registered vehicles, it is evident that RTAs will equally increase (Islam and Al Hadhrami, 2012). A set of robust strategies need to be determined and implemented to reduce accident causation.

Road users

Likewise, traffic environment has mix of competing activities. It includes; other road users, vehicles, pedestrian movement and crossings, motor-cyclists, pedal bicycles, domestic animals, stray-animals, and in other places three-wheeled Tuck-Tuck vans. All these are competing on the traffic environment and particularly where roads and lane are narrow which were initially made for very few vehicles and have not kept pace with expanded traffic volume. This is particularly evident in Mombasa, Tana-River and other Counties. These causes traffic mix, which essentially compromise rules and regulations pertaining to road usage. Traffic rules are not observed in such situations. These portray poor road infrastructural development. Environment and pedestrian protection issues play a role also in the placement of roadside barriers in corridors urban and rural roads. In regard to this, in Europe some countries prefer minimizing interaction between different road users and between vehicles driving in different directions using central reserve and roadside barriers, while in US especially wide safety zone complemented by landscape and trees are preferred. Studies on Motorcyclist Protection Systems (MPS) use traffic volume variables such as annual average daily traffic (AADT) and percentages of different road users and recommend the installation of MPS in roads with high exposure of powered-two wheelers (PTWs). In terms of road geometry, accident statistics and in-depth analyses point out roads with bends between 50m and 150m as specific areas of higher risks. In regard to the influence of cost on the placement of vehicle restraint system (VRS) there are useful methodologies that can be exploited for instant the European economic assessment tool but the main current and future difficulty is to find financial ability and data covering all aspects of a VRS installation and valid beyond a region or national level for the next few years' period.

Road Safety measures/ infrastructures which can reduce traffic crashes for non-motorist

Controlled crossing: These are crossings where a pedestrian/cyclist is able to establish priority over vehicles to cross the road. The traffic on the roadway has to yield to pedestrians/cyclists crossing the road, either because traffic signals (controlled by those crossing the road) force the motorized traffic to stop (e.g., pelican, toucan, puffin crossings), or because of regulation which requires motorized vehicles to stop if pedestrians are attempting to cross at the designated place (i.e., zebra crossings). It can also be known as a 'crossing with VRU priority'.

Cycle lane: An on-road lane for use by cyclists. Can either be exclusive use/mandatory (i.e., a lane exclusively for cyclists use only) or shared use/advisory (i.e., entry by motor vehicles is permitted). The width of the lane can vary from a full width lane to a narrow width alongside the edge of the kerb.

Cycle way: A universal term for cyclist pathways either on the roadway, adjacent to the road way or completely removed from the roadway. These may be variously known as cycle lanes, cycle routes or cycle paths. Cyclist: A person who travels by pedal cycle/bicycle. They can also be known as a bicyclist.

Desire line: A route taken by pedestrians, which generally represents the shortest or most easily navigated route between an origin and destination. It can often be highlighted by erosion created by footfall, particularly on unpaved paths. An investigation of desire lines can help to ensure pedestrian crossings are located at the most convenient location for pedestrian usage. It can also be known as a desire path. These are additional infrastructures to roads, which will attract additional funding or budgetary allocation, which is already inadequate currently.

Safety measures in Traffic Environment

When two or more roads/paths meet at the same level they create a fundamental issue, such as at grade crossings include signalized and non-signalized crossings.

Belisha beacon: flashing amber warning beacons found at zebra crossings in the UK.

Bollard: Vertical posts are used to separate motorized traffic from pedestrians, particularly to stop vehicles encroaching on and parking in pedestrian areas.

Carriageway: All lanes generally used for motorized traffic. It is also known as a roadway (USA). Central reservation: Area in centre of road physically separating opposing lanes of traffic by paving, landscaping, trees and/or a concrete/steel/wire rope safety barrier. It is also known as a median (USA).

Chicane: Build-outs, which are often installed as extra sections of the footway, which extend into the roadway on either side or both sides (normally slightly offset), reducing the width of the roadway, often to just one lane. These forces motorized traffic to reduce speed in order to negotiate the chicane, and where just one lane is provided through the chicane, traffic priority is indicated and vehicles are required to wait until the chicane is clear before progressing. When installed as an extra section of the footway, they serve to narrow the distance that pedestrians are required to cross, so can be used to indicate uncontrolled crossings. It can also be known as a horizontal deflection method.

Another important issue in roadside crashes is related to removing hazards placed in the clear zone. The decision regarding tree removal in the Clear zone and roadside barrier installation is strongly affected by the discussion on the relation between public health and road infrastructure design. According to Naderi (2003) the US Center for Disease Control and the Surgeon General's Office study all the variables which favour active lifestyle living such as pedestrian and bicycle use over the automobile and can improve national health by reducing obesity and related medical care costs. In this context, it is believed that improving the aesthetic aspect of transportation corridors can be beneficial in a double way: by reducing accident frequency and severity and by increasing pedestrian activity. Boulevard treatment and the introduction of green infrastructure within transportation corridors, however, have presented difficulties in relation to the treatment of the Safety Zone. In regard to this, although landscaping as a tool to achieve safer roads is socially recognized, researchers are trying to assess quantitatively its effect on driver behaviour. Several case studies have been produced: a study on five arterial roads in Toronto, between 1992 and 1995 (Rosenblatt and Bahar, 1998); a comparison between the safety performance of 12 couples of parkways and freeways, in four US states (Mok and Landphair, 2003); the crash rate before and after landscape improvement in 10 study sites in Texas (Mok et al., 2006), and a correlation analysis to identify weak relations between the quantity of car accidents and some aesthetic properties of road landscape in Lithuania (Matijošaitienė and Navickaitė, 2013).

Pedestrian crossings protection

The following are internationally recognized road protection strategies, which can be incorporated in road infrastructural development:

Dropped kerb: This is where a raised kerb is lowered to allow easier access to the roadway for mobility-impaired pedestrians, those in wheelchairs and those with prams and pushchairs/strollers. It can also be known as a curb cut (USA).

Dual carriageway: Road where the lanes of opposing traffic are separated by a median /central reservation. *Footpath*: A thoroughfare exclusively for pedestrian use and generally not next to a road (e.g., a shorter quieter route through an urban area) Footway: A universal term for pedestrian paths/pathways either adjacent to or completely removed from the roadway. Around the world, these may be variously called sidewalks (USA), pavements (UK) if next to the road, footpath (UK) if removed from the roadside and Platform/Footpath (India).

Protection of other non-motor road user

All users of a road/roadside travelling by a motorized vehicle (i.e., car, motorcycle, van, HGV, bus) are known as motorized road users. *Non-motorized road user*: All users of a road/roadside travelling on foot or by non-motorized vehicle (e.g., pedestrian, pedal cyclist, horse/donkey rider, wheelchair user, pram). Non-signalized crossing: crossings where traffic signals are not used (e.g., all uncontrolled crossings, zebra crossings). *Pavement*: A pedestrian path beside a road. This is also known as a 'sidewalk' in the USA. *Pedestrian barrier*: Barriers used to help protect pedestrians from errant vehicles at high-risk locations and to control pedestrian movement at hazardous locations and guide pedestrians to cross at specific crossing points. This is also known as a pedestrian guardrail. *Pedestrian bridge*: Bridge specifically installed for pedestrians and cyclists to cross a road at a separated grade from the motorized traffic. They are generally used on roads where uninterrupted traffic flow is required due to the speed and function of the road (e.g., motorways). *Pedestrian facilities*: A universal term for all facilities provided on and off the roadway for pedestrians, including paths and crossing facilities. Pedestrianization: The concept of reserving an area of city or town for pedestrian use only, where all other road users are prohibited or restricted and are re-routed around the pedestrianized area. These areas are generally known as pedestrian zones. Textured ground indicators found on pedestrian footways, particularly at road crossing points, to assist blind and visually impaired pedestrians. Toucan crossing: a controlled, signalized pedestrian crossing that also allows bicycles to be ridden across (i.e., 'two-can' cross). The signal lights indicate both pedestrians and bicycles, and the crossings are typically 4m wide.

Traffic enforcement camera: Cameras, which detect speeding vehicles, vehicles travelling through a red light at an intersection or crossing, vehicles using a prohibited lane (e.g., bus lane) or for detecting vehicles entering a congestion charge zone. It can also be known as a speed camera, red light camera or safety camera. *Uncontrolled crossing*: crossings where the pedestrian/cyclist does not have priority over vehicular traffic and must make a decision about whether it is safe to cross. There are no requirements for motorized vehicles to yield to pedestrians/cyclists attempting to cross, but through their design provide a safer route for all cyclists and pedestrians (including those with disabilities) to cross the road (e.g., using dropped kerbs, tactile paving, central refuges where appropriate). These design features also serve to make drivers on the roadway aware of the fact that it is likely that pedestrians may be attempting to cross the road in these places.

Road markings: This is any markings/material used on a road surface to convey information to the road user. For example, painted lane markings, painted symbols or writing, mechanical markers (e.g., reflective road markers, road studs, rumble strips). *Road signage*: Signs positioned at the side of a road providing information for road users (motorized and non-motorized) about the road ahead (e.g., destinations, speed limits, hazards). *Safety barrier*: A steel, concrete or wire rope construction which aims to prevent vehicles driving into oncoming traffic on dual carriageways (median barriers) or travelling onto the roadside and impacting hazardous objects/pedestrians. It is also known as a guardrail (USA). *Shared space*: A road design concept aimed at integrated use of public spaces which removes the traditional segregation of motorized road users and non-motorized users (e.g., removal of kerbs, barriers, road signs and markings) to promote walking and cycling across the whole area and in turn encourage motorized road users to naturally slow down. *Single carriageway*: Road where the lanes of opposing traffic are not separated by a median/central reservation.

Speed cushion: Speed cushions are a type of vertical deflection method, which typically allows motorcycle riders to pass round the cushion, and emergency service vehicles are wide enough to pass over with their wheels either side of the cushion. *Speed hump*: Speed humps (also known as speed bumps) are a type of vertical deflection method, which extends across the entire roadway, whereas speed cushions do not extend across the roadway. *Speed table*: Speed tables are a type of vertical deflection method, which consists of larger areas of raised roadway, extending across the full width of the roadway and further along the roadway. Tables can sometimes be combined with crossings (with the crossing being on top of the table) or at junctions with large number of VRUs crossing, the road (adopted from Sustainable Road Safety and; La Torre et al., Transport Research Arena, 2014).

The Dutch Experience on Road Safety

The Dutch people consider road safety to be of great personal, societal and political importance (Dutch Information Council, 2005). The current size of the road safety problem in the Netherlands is characterized as unacceptable, and they strive for further reduction

in the number of casualties. They established a taskforce to look after road safety. Working with quantified targets, they have reduced road fatalities by 25% in ten years' time as compared with other countries. The ambition formulated by the European Commission (halving the number of road fatalities in ten years' time) was highly ambitious (European Commission, 2001), but has resulted, without any doubt, in the subject being on the agenda in Europe in several Member States. It has led to renewed attention and continuing efforts. Further the Dutch Mobility Paper (Ministry of Transport, 2004a) states that, while absolute safety and total risk exclusion does not exist, the number of casualties can, without any doubt. There is no lack of ideas, but the question is: at what cost? To this end, they (SWOV) have proposed using the criterion of 'avoidable crashes' (Wegman, 2000). 'Avoidable' in this context means that they know what to do in order to prevent crashes and that it is cost-beneficial in societal terms to do this. In other words: the benefits exceed the costs. Seen from considerations of effectiveness and efficiency, they have added 'and fitting within the Sustainable Safety vision'. Sustainable Safety: an answer to the lack of road safety, a crash can happen to anyone. Everyone makes errors sometimes in an unguarded moment. In most cases, it turns out all right, because such errors only lead to a crash if the conditions at that moment are such that these errors are not sufficiently absorbed. Examples of this include the presence of other road users who react a fraction too late to an oncoming danger, or the presence of a tree in the exact spot where one run off the road in a moment of inattention. There are more than enough examples. Since humans make errors and since there is an even higher risk of fatal error being made if traffic rules set for road safety reasons are intentionally violated, it is of great importance that safety nets absorb these errors. The Sustainable Safety approach in the Netherland has, incidentally, been commonplace in other transport modes for a much longer time under the name of 'inherently safe'. Since the launch of the Sustainable Safety vision in the early 1990s, the road safety approach has shifted from a reactive approach to a general proactive and integral approach to the elements of the traffic system. The idea behind "Sustainable Safety" was fundamentally to make traffic system - with its large speed and mass differences and with its (physically) vulnerable and fallible users - inherently safe. They realized that, if they did not want to burden their children with such a dangerous traffic system, something structural had to happen, and a system quantum leap had to be made. At that time, the term 'sustainable' was chosen in order to make a link with ideas concerning a sustainable society and sustainable development. No waiting around for what the future has in store. It was realized that a new stimulus was needed. Meanwhile, much experience has been gained with the implementation of Sustainable Safety and infrastructural measures, in particular (Koomstra et al., 1992; Wegman & Aarts, 2005).

The Dutch experience is worth copying. They came up with the principles of "Sustainable Safety" which is aimed at preventing road crashes from happening and where it is not feasible, to reduce the incidence of (severe) injuries whenever possible. This is achieved by a proactive approach in which human characteristics are used as the starting point: a user-oriented system approach. These have to do with human physical vulnerability and human (cognitive) capacities and limitations. People regularly make errors unintentionally and are not always able to perform their tasks as they should. Furthermore, people are also not always willing to comply with rules and violate them intentionally. By tailoring the environment (e.g., the road or the vehicle) to human characteristics, and by preparing the road user for traffic tasks (by training and education), they were able to achieve an inherently safe road traffic system. The most important features of inherently or sustainably safe traffic are that latent errors in the traffic system (gaps in the system that result in human errors or traffic violations causing crashes) are, as far as possible, prevented and that road safety depends as little as possible on individual road user decisions. The responsibility for safe road use should not be placed solely on the shoulders of road users but also on those who are responsible for the design and operation of the various elements of the traffic system; such as road engineers, infrastructure, vehicles and education. A set of guiding principles were developed and adopted that achieved sustainably safe road traffic.

For instance, a good example is Traffic planning and Flow of traffic in the Netherland that manifests itself in many ways and with various and different objectives. As long ago as the 1970s, a functional road categorization system had been introduced in the Netherland, which formed the basis for the Sustainable Safety functionality principle (see table 02 below). This principle starts from the premise that roads can only have a single function (monofunctionality) and that they must be used in keeping with that function. The road function can, on the one hand, be 'to facilitate traffic flow' (associated with 'through roads'), and, on the other hand, 'to provide access to destinations' (associated with 'access roads'). In order to provide a proper transition between 'giving access' and 'facilitating traffic flow', a third category is defined: the 'distributor road'. The advanced version of Sustainable Safety maintains these three main

categories as the basis for a functional categorization of the road network. Preventing dangerous actions, people can perform tasks at different levels of control: skill-based, rule-based or knowledge-based (Rasmussen, 1983). Generally speaking, the longer people are trained in performing a task, the more automatic their behavior. The benefit is that task performance requires less time and attention, and that fewer (serious) errors are made (Reason, 1990).

Sustainable safety principle	***Description***
Functionality of roads	Monofunctionality of roads
Homogeneity of mass and/ or speed and direction	Equality in speed, direction and mass at medium and high speeds
Predictability of road course and road user behavior by a recognizable road design	Road environment and road user behavior that support road user expectations through consistency and continuity in road design
Forgiveness of the environment and road users	Injury limitation through a forgiving road environment and anticipation of road user behavior
State awareness by the road users	Ability to assess one's task capability to handle the driving task

Table adopted from (Rasmussen, 1983).

Table 2: Sustainable Safety functionality principle.

To prevent dangerous actions, Sustainable Safety strives to avoid knowledge-based task performance in particular. People have to be sufficiently capable and experienced to take part in traffic, but they also need to perceive what is expected from them and what they can expect from other road users. This is manifest in the predictability principle, the benefits of which can be delivered, according to the advanced Sustainable Safety vision, by consistency and continuity in road design. This means that the design needs to support the user's expectations of the road, and that all components of the design need to be in line with these expectations. People not only act dangerously because they make errors unintentionally; they can also exhibit dangerous behavior by intentionally violating traffic rules. In situations where the road environment does not stimulate proper behavior, a sustainably safe road traffic system benefits from road users who spontaneously obey traffic rules from a normative point of view. To achieve this, traffic regulations have to fit with the environment, and people have to be educated about the logic and usefulness of rules. Where people still fail to comply with the rules, police enforcement to a level where a reasonable chance of being caught is perceived is the usual measure to enforce compliance. Another element in the advanced vision is that traffic has to be sustainably safe for everybody, and not just for 'the average road user'. Fuller's task capability interface model (Fuller, 2005) supplies a theoretical framework here. Fuller's model states that road users' task capability is the sum of their capacities less the sum of their impairments caused by their present state (e.g., because of fatigue or use of alcohol). For safe road use, the task capability has to be large enough to meet the task requirements. The environment primarily dictates these task requirements, but the road user, for instance by increasing or decreasing driving speed, can also alter them. A new element in Sustainable Safety is the principle of state awareness. This principle requires that road users should be able to assess their own task capability for participating in traffic. Task capability can be insufficient due to a lack of competence (e.g., because of a lack of driving experience), or because of - or aggravated by - a state of mind that temporarily reduces the task capability (e.g., because of fatigue, or the use of alcohol or drugs). Since task capability differs between individuals (e.g., inexperienced and elderly road users with underdeveloped or diminishing competences respectively, and fatigued 'average' road users, or road users under the influence of alcohol or drugs), generic road safety measures are a necessary basis for safe traffic. However, for the group of road users with a lower task capability in particular, these measures are not sufficient for safe participation in traffic. Therefore, generic measures have to be supplemented with specific measures aimed at these groups or situations involving them. Specific measures can be found in the areas such as regulation, education, enforcement (e.g., banning drivers under the influence of alcohol or drugs), and Intelligent Transport Systems (ITS). Dangerous actions can also be affected by explaining and gaining support for the principle of social forgivingness. More experienced road users can, by means of forgiving driving behavior (in terms of being anticipative or defensive), increase the room for manoeuvre of less experienced road users. Errors should still be regarded as errors by the less experienced, in order that they can learn, but a forgiving approach should lead to fewer or less serious crashes. Dealing with physical vulnerability, if road users perform

dangerous actions that lead to crashes, the human body's integrity is jeopardized. This vulnerability results from the release of kinetic energy and the body's biomechanical properties. To deal with the issue of vulnerability in a proactive fashion, Sustainable Safety requires that controls are placed on factors that may intensify the severity of a crash: differences in speed, direction and mass. This forms the foundation of the homogeneity principle. This principle states that, where vehicles or road users with great differences in mass have to use the same road space, speeds will have to be so low that, should a crash occur the most vulnerable road users involved should not sustain fatal injuries. In addition, where traffic is moving at high speeds, road users should be separated physically. Based both on crash tests between pedestrians and cars and on ideas developed in the Swedish Zero Vision (Tingvall & Haworth, 1999), the advanced Sustainable Safety vision proposes safe speeds for different situations. Unfortunately, there is no sufficient scientific knowledge to define safe speeds for motorized two wheelers and heavy vehicles. This issue has also not yet been resolved in practical terms. Separation from other traffic would be the best solution, but it is unclear how this can be realized in practice. The principle of physical forgivingness (a forgiving roadside) can also contribute to reducing injury severity in crashes. Improved road safety in the Netherlands Road safety developments, the first road crash victim died in the Netherlands more than one hundred years ago, and since then, mobility and the number of road casualties has grown quickly. In the early 1970s though, a trend evolved of increasing mobility combined with improved road safety. This trend still exists, albeit with some discontinuities over the years. This downward trend in the number of road casualties is also visible if viewed as a cross section by a) road transport means, b) road type and c) age group. Two types of road traffic participation stand out in this type of analysis: motorized two-wheeled vehicles (due to the relatively high risks), and the passenger car (due to its dominant role in road crashes: the number of car occupant casualties is comparatively high, but risks are relatively low and are decreasing steadily). The car performs a double role in road crashes. In conflict with vulnerable road users (i.e., pedestrians and cyclists), the car is a disproportionately strong crash opponent; in conflict with heavy goods vehicles and in single-vehicle crashes against fixed roadside objects, they are the weaker party. These single-vehicle crashes occur quite frequently on rural roads. Rural roads allowing all kinds of traffic participants yield the highest risks, probably because of the relatively high speeds in combination with the mix of different types of road user. Looking at the number of road casualties and the risks of different age groups combined with gender, it is striking that both young people (particularly young males) and the elderly (aged over 75 years) have a higher risk of being involved in a crash. The reasons are, in particular, age-specific characteristics, and for young people the added lack of experience in road use. Looking at road safety in the Netherlands in an international context, it is apparent that they are amongst the safest country in the European Union and the world. Compared with other well-known top performers - Sweden and the United Kingdom most notably - road safety statistics reveal that the Netherlands has achieved the highest reduction in the number of road casualties and, currently, the Dutch road safety performance level is on a par with these two other countries. Nevertheless, the current number of road casualties is still considered unacceptably high in all three countries. Low-income countries particularly, Kenya have a dire need to emulate their strategies to reduce road carnage using the Dutch experience.

Discussion

Strategies of curbing Road Accidents

Road traffic accidents are attributed to several basic risk factors: increased vehicular use, unroadworthy vehicles, poorly maintained roads, high speeds, large differences in speeds and masses between road users, and people's physical vulnerability. In addition, there are a number of road user factors that further increase crash risk, such as lack of experience (a particular problem for young road users), use of psychoactive substances (including alcohol and prescribed or illicit drugs), fatigue, emotional state and distraction (e.g., due to use of mobile phones while driving). However, crashes are caused by predominantly unintentional errors by road users. Since it is quite often stated that hard-core or repeat offenders cause crashes, an investigation regarding to the distribution of crash causes, has led to the view that it is quite often difficult to attribute crash causes to actions that are either 'unintentional errors' or 'deliberate violations'. Material such as police crash registration forms, often fall short in their examination of the road user actions that precede crashes. Moreover, a combination of factors are usually involved, making it even more difficult to separate out the specific cause. Nevertheless, the view emerges that deliberate violations cannot be neglected as a factor that increases the probability of a crash.

Relevant future developments need to consider several societal developments that may have an impact on (tackling) road safety. Firstly, increasing mobility is coupled with increasing economic growth, both for passenger and freight traffic. It is not yet clear what this means for traffic distribution over the available road network with regard to travel times, speeds and modal distribution. It is expected that economic growth will also bring further quality improvement in the vehicle fleet. The 24-hour economy will undoubtedly bring about increasing fatigue in road users. Considering demographic trends, it can discern an overall ageing of the population. Ageing combined with increasing individual choice will probably mean a wider urban sprawl, requiring longer travel distances. In addition, the lifestyle of double-income families gives rise to more vehicle use because commuter traffic tends to be combined with the dropping-off and picking-up of schoolchildren. An increased societal aggression and intolerance is perceived that can affect road traffic. The increased call for 'norms and values', coincides with an increased demand for a clean and healthy environment. It can be expected that this will have an impact on the organization of spatial planning. Road safety considerations deserve a prominent place in these processes.

It is worth noting that some vehicles praying the roads are not in good mechanical conditions. It is normally a reckless driver who will drive a vehicle, which does not meet minimum traffic requirements and being unroadworthy. This indeed puts the driver and other significant road users in danger. It is a practice that should not happen in the first place and there should be a policy to ensure that traffic rules are followed in safeguarding the interest of other road users. Individual or public vehicles should of necessity be serviced regularly and insured accordingly so as to offer the ideal services due to them.

Implementation of policies clearly shows a tendency towards decentralization on the one hand, and more societal influence on the other. Moreover, citizens should get more responsibilities in general terms with decreasing governmental responsibilities. This increase in personal (and road user) responsibilities and the corresponding decrease in governmental responsibilities suggest that the improvement of safety in an already busy road traffic system can only be safeguarded by centrally structured measures based on the Sustainable Safety vision. "The sustainably safe traffic system has an infrastructure that is adapted in design to human capabilities, vehicles having means to support and simplify human tasks and that are constructed to protect the vulnerable road user, and a road user who is trained, educated and informed adequately, and controlled where necessary." However, it's equally useful to employ the use of low-cost solutions, in particular concerning a general 30 km/h speed limit in urban areas and a 60 km/h speed limit on rural access roads instead of lower, safer limits. These low-cost solutions are understandable in order to offer support for Sustainable Safety such that it can start off. Speed cameras have an important place identify errant and ruddy drivers violating traffic rules.

The lack of knowledge on education is also worth noting. Much knowledge can still be gained concerning infrastructural measures. This knowledge is necessary to be able to make cost-effective advances in the battle for road safety. Based on the existing knowledge, it has been estimated that the aggregate effect of all implemented infrastructural measures within the framework of Sustainable Safety resulted in a reduction of 6% in the number of road fatalities and hospital admissions in the Netherland (Wegman et al., 2006). Therefore, the Netherland Road system is not yet sustainably safe but is on the right track. It is advisable to involve all the stakeholders, such as the police, judicial authorities, road engineers, interest groups, and the private sector in this implementation process. The principles of functionality, homogeneity and predictability have always been central. They want to maintain these three principles in the future, with forgivingness (a forgiving road environment) added as a fourth principle concerning infrastructure. Good progress was achieved in the Netherland's translation of the original three principles into guidelines for road design and into practical implementation, showing positive safety results. However, they have concluded that some problems are still waiting for a solution. With respect to functionality, there was need to set requirements for categorization plans at network level. The principle of homogeneity was developed further in Sustainable Safety with the idea that, prior to a collision, speeds are limited to a level such that only 'safe crash speeds' pertain. In the Sustainable Safety vision, vehicle safety occupies an important position because the outcome of certain crash types is determined by crash speed and direction, and the protection that the vehicle provides (to the occupants and to crash opponents). From this perspective (the perspective of the homogeneity principle), stricter requirements was put on road infrastructure design and heavy vehicles on the one hand, and on cars relative to vulnerable road users (pedestrians, cyclists, and also motorized two wheeled vehicles) on the other hand. Travel speeds needed to be adapted appropriately. This was to be the norm for the design of road traffic.

Seatbelt locks are another possibility. In the still longer term, they have thought of more automated traffic flow management in order to realize a truly sustainably safe traffic system.

Education: Traffic education in various forms plays an important, albeit perhaps underexposed role in Sustainable Safety up to now. By the term 'education', simply mean teaching, instruction (aimed at specific roles in traffic, such as driver training) and campaigns. Within sustainably safe road traffic, it is important also to use people's capacity to teach themselves. In their view, education should aim at five behavioral themes: 1) creating an adequate understanding of the road safety problem and an acceptance of Sustainable Safety measures as a means to improve road safety; 2) encouraging the making of conscious strategic choices (modal or vehicle choice, route choice); 3) counteracting intentional violations; 4) preventing the development of undesirable or incorrect behavior; 5) preparing 'novices' as much as possible. Education is not a panacea, it cannot be a substitute for other interventions (a sustainably safe road user environment), but it does provide an essential complement to them. For 'learning', the Netherlands's road policy has taken human characteristics as a starting point. By taking into consideration, more than in the past that road user learns continuously from their experiences it is possible to assemble a coherent package of measures to direct the learning process in the direction desired. Formal education is required to teach correct behavioral routines; however, practicing these routines needs to take place in informal education. Education's key task is to focus on those subjects that are difficult to be learned directly from traffic because the relationships cannot be clearly deduced. Examples are; the relation of road safety to driving speed, the organization of the transport system, the road design and the allowed manoeuvres (e.g., understanding the 'essential recognizability characteristics'), overestimation of one's capacities, and so on. This may also help to make the principles of state awareness and forgiving road user behavior more tangible (Koornstra et al., 1992; VNG et al., 1997; Fuller, 2005).

In order to develop an effective road safety and levels of the road transport system and its components in Emerging Economies, there is a need to focus the attention on vulnerable road users (VRUs), the Netherland experience suffice and need to be adopted. Again, the overall scope of reducing the number of fatalities and severity of injuries caused by road accidents in developing countries including Kenya require developing guidelines, and recommendations; for effective Road Safety Management (RSM) procedures. Safe Road Infrastructure (SRI) designs and Road Safety Audit/Inspection (RSA/I) procedures focused on Vulnerable Road User (VRU) safety in Emerging Economies are fundamental. This should utilize local knowledge information, transferability issues and existing/new technologies to generate a set of guidelines and recommendations for developing safer roads thus Road Safety Management. There has been a progressive shift in RSM procedures over the past 50 years, with gradually increasing ambitions in terms of results. The most recent development in RSM involves target setting frameworks which involves a three-tier management system: institutional management functions (including results focus, co-ordination, legislation, funding/resource allocation, promotion, monitoring/evaluation, traffic education, research development and knowledge transfer) which produce interventions, which in turn produce results. They can be subjected to evaluation.

More attention needs to be devoted to education aimed at minimizing exposure to dangerous situations. Current traffic education is overly directed towards training in operational skills, and too little towards acquiring an understanding of traffic that supports safe participation in it. Above all, traffic education has become a matter of the government (including schools) to a greater extent than necessary, and this has caused the education to be less effective. It is necessary to broaden educational care, particularly where operational training of novices is put back into the hands of parents and careers. To create such a 'broader learning environment, consisting of both formal and informal education, coordination between organizations and guidance on content are needed in order to help these organizations carry out their tasks competently and with sufficient resources. Central government has an important directorial role to play here. Regulations and their enforcement in sustainably safe road traffic environment are feasible. Regulation forms a foundation for the safety management of traffic processes, minimizing latent system errors, and restraining risk factors. Ideally, in sustainably safe road traffic people comply with the rules (spontaneously) without having to make an effort and without feeling negative about it. On the one hand, this can be accomplished by adapting the traffic environment (such as infrastructure and vehicles) in such a way that it supports the (prevailing) rules as much as possible. This would be the basis to prevent latent errors in the traffic system, because it tackles the cause of traffic violations at the earliest possible stage. On the other hand, intrinsic motivation could prompt people to

comply with rules spontaneously. Unfortunately, spontaneous traffic rule compliance is far from being a reality and it is highly doubtful that it could be relied on in the future. Not everyone is always motivated to comply with the rules, not even when the environment has been adapted optimally. The threat of penalties is needed to deter these road users not willing to comply with the rules, for instance by making the cost for non-compliance outweigh the perceived benefits of it. Current enforcement practice can be optimized by using more effective and efficient methods. Specific enforcement, focused on target groups and inspection prior to taking part in traffic, fits within sustainably safe road traffic (an aid in the principle of state awareness). In order to lower the number of violations substantially, CCT cameras and intelligent transport systems provide some solutions for the future. To prevent people violating rules intentionally, intelligent systems can be employed as advisory systems. For dedicated target groups, this type of system can also be used as a radical, measure for serious offenders.

Speed management: Speed and speed management are key elements in Sustainable Safety, because speed plays an important role both in crash risk and in crash severity. That is why speed play an important role in all Sustainable Safety principles, more particularly in homogeneous road use. With respect to speed, the essential matter is to manage crash speed in such a way that severe injury is almost completely ruled out, starting with certain types of crash (e.g., frontal and side impacts) and the level of protection for car occupants. Where there is less protection (e.g., for pedestrians), crash speeds should be lower. It's important to make safe speed limits as a point of departure for the whole of the road network. However, it is true that many current speed limits are being very widely flouted, and some individual road users experience 'going fast' as fun, exciting and challenging. SWOV estimated that if everyone were to comply with existing speed limits, this would lead to a reduction of 25% to 30% in the number of casualties (Oei, 2001). If safe speed limits were to be introduced, and if road users complied with them, the benefits could be even greater. Speed limits have to be credible for the road user; that is: they have to be seen as logical in the given circumstances. In the short term, apart from setting safe and credible limits, good information needs to be given to road users (principle of predictability). There are two instruments that have proved effective in the past and that, if put into practice appropriately, will also be usable in the future: physical speed reducing measures and police enforcement. In the longer term and making, it dynamic to particular roads is feasible. This will result in speed limits that are not coupled inflexibly with a given road, but are adapted to prevailing conditions. It is important to identify criteria for safe and credible speed limits and minimum requirements for road user information in order to assess if the road environment and the existing speed limits are in conformity with each other. This will help to implement adaptations (to the road environment or the speed limit) where necessary; − to re-orientate regarding enforcement of speeds of intentional violators; − to prepare for and to introduce dynamic speed limits such as speed governors. It is fundamental to look for appropriate harmonization of speeds that serves safety, to the environment and accessibility.

Drink and drug driving: Driving under the influence of alcohol continues to be a persistent problem. Simultaneous use of different drugs and combined use of alcohol and drugs brings about a considerable increase in crash and injury risk. Although driving under the influence of alcohol may have decreased with the introduction of alcohol-brow in Kenya, the decrease in the number of casualties has fallen short of expectations. Apart from an increase in the combined use of alcohol and drugs, the number of serious offences has decreased less than the number of less serious violations. Heavy drinkers may constitute only a fraction of all offenders, but they are responsible for three-quarters of all alcohol-related casualties. Furthermore, current problems are concentrated during the night and weekends as they were in the past, with customers of the catering industry (e.g., pubs, bars and restaurants) and with young males. Combined use of alcohol and drugs is most prevalent in this latter group. The approach to combating drink driving takes place at several levels: through legislation, police enforcement, education, punishment, rehabilitation and exclusion. In some of these areas, considerable further gains can be achieved. The chosen policies can be maintained for the fight against driving under the influence of alcohol. The number of offenders reached an all-time low in 2004. Police enforcement on alcohol use has doubled since 2000, particularly since the setting up of dedicated traffic police enforcement teams. Much can also be improved in the area of rehabilitation of alcohol offenders, particularly by fitting the cars of more serious offenders with Alco locks (principle of state awareness). However, young people taking part in traffic for the first time on their own (as cyclist, moped rider, motorcyclist or car driver) do not have the skills that older, more experienced road users possess. Young road users behave more dangerously than other age groups. The start of a driving or riding career corresponds with a relatively high risk of crash. The comparatively high risks are caused by a combination

of lack of experience and age-specific (biological, social and psychological) characteristics. A sustainably safe environment will lead to lower risks because a safer environment (generic measures) compensates for the lack of experience. This risk can be reduced further by ensuring that young people take part in traffic in less dangerous circumstances (specific measures, e.g., driving without passengers at night).

Education and traffic enforcement can be made more effective more easily if the environment has been designed to be sustainably safe. Emphasis should be put on education and driver or rider training in basic skills, and more on acquiring an understanding of the traffic system and of their own capacities. Formal and informal learning should reinforce each other. The graduated driving license for novice drivers is an effective approach. Rowdy behavior is not appropriate in road traffic environment. Police enforcement needs to be intensified, accompanied by suitable penalties for novice road users (often-young people). In addition to punishing inappropriate behavior, rewarding appropriate behavior can improve safety. An example is a special no-claim insurance bonus to reward careful novice drivers or riders (Dutch Information Council, 2005).

Cyclists and pedestrians Walking and cycling are healthy and environmentally friendly activities, and should be safe. Walking and cycling (safely) are most important modes for young (school) children, and the elderly. These vulnerable groups are particular beneficiaries of a sustainably safe road traffic system design, specifically based on the principle of homogeneous use. Pedestrians and cyclists are vulnerable in crashes with other types of road users, because they are unprotected and because other types of road users move at higher (sometimes too high) speeds. Crash speeds of motorized vehicles need to remain below 30 km/h in order for pedestrians or cyclists to survive the crash. This means that pedestrians and cyclists have to be separated from high-speed traffic. If this is not possible, the result of conflicts should be such that pedestrians or cyclists are not severely injured (forgivingness). This requires both provisions for motorized vehicles ('friendly' car fronts, and under-run protection for heavy goods vehicles, matatus -mini-buses allowed to carry12 to 14 passengers- and buses) and for speed reduction for these vehicles. Speed reduction needs to be applied on access roads but these need to be investigated further because there are signs that the low-cost design of both 30 km/h and 60 km/h roads do not fit these speed limits well enough. Speeds also need to be less than 30 km/h at those occasions where pedestrians, cyclists, and motorized traffic meet (on distributor roads with a 50 km/h or 80 km/h speed limit). These locations should follow logically from route plans for cyclists and pedestrians. The construction of roundabouts and raised crossings can be effective here. The downward trend in crash statistics for pedestrians and cyclists will be evident. Therefore, the slogan could be: proceed on the chosen path. This path comprises: mix traffic where speeds are low, separate traffic where speeds are too high, and introduce targeted speed reduction where pedestrians and cyclists meet motorized traffic flows. Here, SWOV introduces two new ideas: the Toucan crossing (joint pedestrian and cyclist crossing), and the two-path (joint use of pavement with a separate lane for both pedestrians and cyclists). Incidentally, it is only logical to address pedestrians and cyclists about their own responsibilities for safe road use; that they behave predictably, for instance using their bicycle lights at night, and do not cross streets while the lights are red. This will also remove a cause of crashes.

Motorized two-wheelers: Motorized two-wheeled vehicles do not fit well into sustainably safe traffic, because they have a high vulnerability/injury risk in crashes with other motorized vehicles, because motorized two-wheeled vehicles are quite often not noticed by others, and also because they often move at high speeds. The combination of juvenile recklessness, tuned-up engines, and sometimes-excessive speeds results in relatively high risks for this road user category. Only a few Sustainable Safety measures provide a truly substantial casualty reduction in crashes involving motorized two-wheeled vehicles. This leads us to a fundamental discussion concerning risk acceptance in a risky society, and to the questions of what is a reasonable and responsible expectation of risk reduction, the distribution of individual and collective responsibility with respect to risk-associated behavior, and so on. There is an urgent need to facilitate the safest possible way of using motorized two-wheeled vehicles, given their inherently dangerous characteristics. There are definitely some, although limited, possibilities: obstacle-free zones, advanced braking systems, in rider training, much more emphasis needs to be given to recognizing and anticipating dangers. In the same way as for young and inexperienced drivers, a positive effect may be expected from graduated driving licenses (both for motorcyclists, and for light moped and moped riders). Research (from the UK) has shown that motorcyclists often have incorrect risk perception and risk awareness; this may also be true for light moped riders. When the graduated driving license for novice drivers is introduced, it should be recommended that the period of the

training phase for novice riders of motorized two-wheeled vehicles be extended. When riders have mastered higher order skills, they can participate in traffic under more dangerous conditions.

Heavy goods vehicles: The freight transport industry represents a large economic interest in the economy and therefore, it is important to manage freight transport flows safely. This is also important for the sector's efficiency and image. Dangerous heavy goods traffic usually means a lack of safety for the other crash party. Fatal crashes already occur at very low speeds (particularly for the lighter collision opponent). It should be acknowledged that there is a high level of incompatibility between the heavy goods vehicles and all other road users. There is very little else, that can be done about this structural problem other than separating heavy goods vehicles from other traffic. It is also feasible to consider the use of trains/railways to transport freight and passengers, since accidents occurrence from this mode of transport are minimal. From the Sustainable Safety vision, everything possible has to be done to prevent unnecessary movement, and then to manage the mileage travelled as safely as possible. Learning from other transport modes and based on an analysis of heavy goods vehicles safety problems, SWOV (SWOV-Institute for Road Safety Research, The Netherlands) advocates: – two designated road networks for heavy goods transport and light goods transport; – two vehicle types adapted to the road and traffic situation; – two types of drivers with different skills requirements. The leading idea is to separate heavy goods vehicles and other traffic as much as possible in place or time. To this end, a logistic system has to be developed where heavy goods vehicles use the major road network, and are in contact with other, mostly more vulnerable, road users as little as possible. 'Light goods vehicles' made compatible with other traffic then use the remaining road network. This may sound unrealistic and unattainable particularly in low-income countries considering the initial financial input that may be required, but the investment in the end will be cost-effective. Furthermore, the logistics system should be designed such that safety is a design requirement, as is common practice in other transport modes. This also means that the sector develops additional professional skills further. It is also important that companies improve their own safety cultures. It is also important to mention the primary role: of the national government, county and local authorities, interest groups, and research institutions. The role of the police and the judiciary is also critical in Sustainable Safety. However, the national government's role should then be characterized as 'policy innovator', now that the role of 'central policy decision maker' is paramount. Further definition of the role at the national level with respect to Sustainable Safety is desirable as well as that of the law enforcement agents (police, judiciary). It is recommended that the process should be facilitating and encouraging further policy innovation, giving particular attention to facet policy and integration with other policy areas. Decisions have to be made that reconcile different interests, and it goes without saying that 'road safety' will only be part of these integral considerations. The county governments and local communities will have to see to it that 'road safety' is explicitly taken on board in a transparent decision-making process, making it clear how (regional) safety targets can be met. The role of local communities is one of providing feedback, both to citizens and to other authorities. Local politics can play a role in stimulating and manifesting the citizens' (latent) demands for improved safety and in the actual implementation of Sustainable Safety. Interest groups act as critics, and are sometimes ideologically motivated. They can keep those responsible on their toes. They have an essential role to play, albeit that this role is more complex and uncoordinated because of policy fragmentation. Interest groups can also link Sustainable Safety with other societal developments (sustainable society, environment, quality of life, etc.). Interest groups may feel challenged to make road safety manifest, based upon issues of concern to citizens, and to channel it towards decision making about Sustainable Safety (Dutch Information Council. 2005).

Quality assurance: In order to attain a sustainably safe traffic system, it is important to counteract latent errors. This can be achieved with the aid of quality assurance. Various considerations and developments lead to the conclusion that this link is necessary for the high-quality delivery of Sustainable Safety, but which is at present lacking. A good example of a situation where such quality assurance is needed is in offering road users a recognizable and understandable road design that facilitates the predictability of the road course and other road users' behavior. To this end, road authorities should agree on a certain level of uniformity of road design. This possibility does not exist currently but is fully accepted in other branches of the traffic system. For example, transport companies are required by law to incorporate safety into their business (safety assurance systems). However, this is not yet a reality within road transport operations, apart from the transport of dangerous goods like petrol and gas. The system of (overarching) quality assurance should be an addition to the quality control that each organization concerned provides itself. Quality assurance will have to be directed at all road traffic components. There is a dire need to conduct an exploration into this area. It is interesting to see how politicians

judge the observed 'quality deficit' and the desirability of inspection as part of quality assurance for the further implementation of Sustainable Safety. More research is needed to prepare this political choice, weighing the benefits and disadvantages. If the choice were to install a (central) supervisor, then their involvement would have to be such that the autonomous competences of authorities are not affected, assuming that those responsible keep and fulfill their own responsibilities. That is: one knows the rules, norms, requirements and so on, and one acts accordingly, or requires third parties (e.g., contractors) to act accordingly. This should satisfy the requirement for the first step of quality assurance (competences and capabilities are sufficiently covered). The quality assurance system needs to have a legal basis. It is imperative to develop this system for road authorities. Legislation could take the form of a framework law or principle law as a basis for (delegating) arrangements concerning road safety priorities. A phased structure can be chosen in such framework or principle law aimed at road authorities. This could look as follows: − restricting unclear commitments by supervision of road authorities at arm's length; a basis is constituted for requirements concerning dissemination of information and knowledge, safety assurance systems, training, audits and reviews, terms of reference for contracting, etc.; − the assurance that safety is taken on board and weighted in spatial planning and transport and traffic plans, e.g. by means of impact assessment reports; − conformity and uniformity in infrastructure design, operation and maintenance; − compulsory analysis and remedial action in case of crashes and latent errors; − compulsory safety monitoring, both in terms of crash statistics and process indicators. It is feasible in starting with four headings: − the obligation of the Minister to report to Parliament progress on road safety indicators and on progress made by other authorities (also process indicators); − implementation of road safety audits; − indication of road safety impact assessment of sizeable investments, for instance within the framework of infrastructure plans or environmental impact assessments of these plans; − revision of existing guidelines and recommendations for road design, such that they are usable in the quality assurance system as discussed. To avoid misunderstanding; the intention is not to accelerate the implementation of Sustainable Safety by means of the appointment of a supervisor. The intention is to implement Sustainable Safety better. To this end, agreements will have to be made within the regular political and administrative arrangements. Quality assurance should not only be embedded within the organizations, but also embedded more completely through a supervisory agency.

Funding: Funding road safety measures', including Sustainable Safety, is an urgent and serious matter. It requires continuous attention because the available funding does not cover all needs. Structural funds are also insufficient. Often, the road safety budget is not earmarked for the purpose but forms part of another budget line which makes it unclear how much is available to meet road safety needs. This paper has restricted itself to a category of expenditure that is highly relevant for the implementation of a sustainably safe traffic system, that is, infrastructure investment, and more particularly, regional infrastructure. Funding needs are known to be high here, and existing available budgets are equally insufficient. Before discussing the issue of funding, we need to flag up that economic justification can be given since government is, itself, active in road safety investment, and should not expect 'the market' to be responsible for road safety improvement. In economists' terms: because the market fails, government intervention is justified. A second relevant point is that investments in Sustainable Safety (CPB et al., 2002) can be characterized as robust investments (societal cost-effective investments and a proper governmental task). Three possibilities have been investigated to cater for identified funding need: 1) increasing liability for road crash damages, 2) pricing policy for road use, and 3) more money from regular and existing budgets. The first two options are not thought to lead to more resources for the government for various reasons. If we stick to the idea that the introduction of road use charging would have to be 'budget neutral', this option does not bring in anything extra by definition. The third option therefore remains, which is a realistic option, but is dependent on the political will to free up the money. It is imperative that a multi-track approach is followed and that a committee is formed (Paying for a Sustainably Safe Infrastructure) to oversee the development of this issue. Accompanying policy, it is fundamental that the implementation of Sustainable Safety to be better and easier if attention is devoted to four related topics. These are brought together under the term of 'accompanying policy': integration, innovation, research and development, and knowledge dissemination. Using a variety of criteria, it is plausible that the implementation of Sustainable Safety will not so much take place within sectoral policy, but rather as an element of other policy areas (facet policy). However, there are two lines of development: enlargement of the area of work, and possibly organizational integration with other topics. Integral considerations are desirable regarding traffic and transport (quick, clean and safe) and road infrastructure investment decisions. Integral considerations and cooperation in implementation are complicated in terms of content and organization. Therefore,

there is need to recommend using Sustainable Safety as a road safety communication carrier to citizens and road users. In this way we can obtain more societal acknowledgements for road safety, the Sustainable Safety principles will become better known, and support can be built up for tangible measures. A National Road Safety Initiative (like the National Transport and Safety Authority- NTSA) can facilitate combining of resources, and this way it can aid the realization of its mission: the exchange, dissemination, and development of knowledge about road safety, and about established road safety results of all those involved. To this end, the objectives and targets of reduction of road crashes and deaths by half by year 2030 can be achieved faster as we focus our attention of scaling down road carnage because we have the knowledge and possibility of mobilizing the necessary resources.

Conclusion

The study reveals that Road Traffic Accidents (RTAs) are a global problem with ever-raising trend. Likewise, it is a serious problem in Kenya. Lack of road sense has further complicated the matters. Many deaths and loss of property occur due to this event every year with a trend of increasing. To scale down its effect in the country, both the government and civil society and development partners should join hands and take strong actions especially for improving road infrastructure, retraining of drivers, replacing old vehicles with newer ones and running educational awareness programs to different groups of people in the country. There are many causes behind these accidents. Lack of experience, over confidence, violating traffic rules, overcrowded roads, are among the causes of accidents. The people walking along the road may cross the road from anywhere. They do not know traffic rules. Some people take driving as an amusement and drive carelessly. They even drive drinking and talking on the mobiles while driving. The most important strategy is discipline. If people are disciplined, they will follow the system. After people start following a system, such events will easily be controlled. We should train common people, making them aware of traffic rules. Giving of license should be restricted. Incapable persons should not be given a driving license at any condition. The import of too many vehicles should be banned; instead, we should introduce the use of bicycles to improve people's health and use of railways to transport freight/goods. The law enforcement agencies, civil society, engineers and individual road users should be proactive in curbing road crashes.

Proper First Aid management at the site of accident can prevent further injury and death of severely injured. Identification of injured people at the site and proper way of evacuation and timely transportation is fundamental in saving lives. The situation demands concerted and urgent response to prevent RTA related deaths and injuries.

Recommendations

Drivers of personal, public vehicles and transporters of goods need re-education, continuous road education, mind shift, ethical code of conduct, etiquette and application of appropriate skills and techniques while driving and make rational use of the road amidst other vulnerable road users.

Political support in policy formulation and implementation along with traffic enforcement is key in curbing traffic accidents. The safe system approach to road safety aims to ensure a safe transport system for all road users. Such an approach takes into account people's vulnerability to serious injuries in road traffic crashes and recognizes that the system should be designed to be forgiving of human error. The cornerstones of this approach are safe roads and roadsides, safe speeds, safe vehicles, and safe road users, all of which must be addressed in order to eliminate fatal crashes and reduce serious injuries.

Road signs and marking should be placed in strategic areas, conspicuous and clear including black-spots warning placed where both drivers, pedestrian and other significant road users can be able to see them.

Areas identified as black-spot should have vehicle restraint systems (VRS) and motorcyclist protection systems (MPS) as well as CCTV to monitor offenders and a nearby free roving emergency break-down and First-Aid team to offer support in saving lives of injured people.

Facilities should be provided on and off the roadway for cyclists including paths, crossing facilities and parking facilities. Pedal cyclists use should be encouraged however, apart from reducing traffic congestion and accidents; they can offer health benefits to

individuals.

Sustainable road safety to be based on individual road user's decision, geared towards personal responsibility, tailoring traffic environment to human characteristics by training and education, improving road network, control of speed, direction and mass to vulnerable road users.

Conflict of Interest

I declare that there is no conflict of interest.
All references and citations have been acknowledged accordingly.
The ethical clearance was not applicable in this study.

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