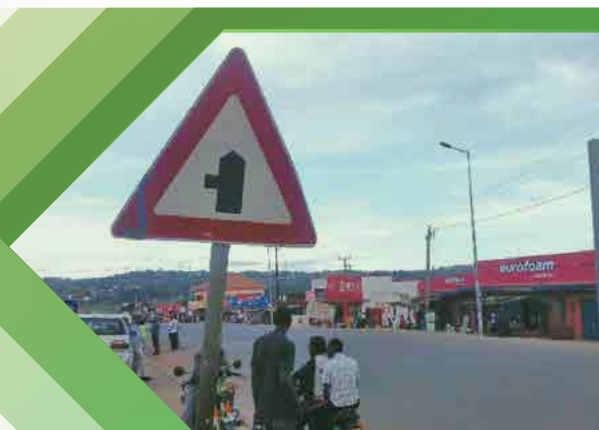




**NORTHERN CORRIDOR TRANSIT AND
TRANSPORT COORDINATION AUTHORITY**



REPORT ON BLACK SPOTS SURVEY ALONG THE NORTHERN CORRIDOR ROUTES IN RWANDA AND UGANDA

February 2020



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Foreword

On behalf of the Northern Corridor Transit and Transport Coordination Authority (NCTTCA) secretariat, I am pleased to present the report on the black spots survey conducted along the Northern Corridor routes in the Member states of Rwanda and Uganda.

This report is in line with the NCTTCA 2017-2021 Strategic Plan especially under its strategic objective # 2 related to improving safety in all modes of transport. In addition it meets one of the recommendations of NCTTCA Executive Committee which considers road safety as a major concern within the Northern

Corridor member states, thus relaying the charter on road safety adopted at the African Union level during its Summit held in Addis Ababa, Ethiopia, 31 January, 2016.

Conducting a survey to identify black spots is therefore a crucial step in discovering the real causes of traffic accidents – which have a huge impact on health and development -, with a view of proposing adequate measures to mitigate the risks and damage observed along the Northern Corridor route.

Surveys in Rwanda and Uganda have shown that causes of accidents mostly originate from the careless driving, or from vehicles condition, or from road infrastructure conditions, and finally from pedestrians behavior. Based on the findings at each black spot surveyed, this report suggests specific recommendations for improvement of the situation observed.

For better management of black spots, Guidelines will also be developed. They will reflect our conviction that most issues related to road safety can be resolved if the Government, in collaboration with the development partners and the NCTTCA join their efforts and work to educate road users on road safety by enforcing the regulations in our member states.

I would be remiss if I did not mention that this report is the result of close collaboration between the Permanent Secretariat of NCTTCA, Ministries in charge of Transport and Infrastructure, National Police and Transporters Associations in both Rwanda and Uganda whom I would like to thank for their active participation in the surveys conducted in their countries from November 7 to 16, 2019 but also, for their inputs to this report.

I finally renew NCTTCA commitment to work with our member states and development partners towards improvement of road safety along the Northern Corridor.

Omae NYARANDI
Executive Secretary.

CHAPTER ONE

1. INTRODUCTION

1.1 Background

The Northern Corridor is the busiest transport route in the region that links the landlocked economies of Uganda, Rwanda, Burundi, South Sudan and Eastern DR Congo to the maritime port of Mombasa in Kenya. It also provides links to Ethiopia and Northern Tanzania.

The Corridor consists of the road network from Mombasa through Nairobi to Kampala, Kigali, Bujumbura, Juba and Goma, Beni & Kisangani. It also includes the rail network from Mombasa to Kampala, the oil pipeline from Mombasa to Nairobi, Eldoret and Kisumu, and inland waterway system around Lakes Victoria, Kivu and Tanganyika.

Studies by Kenya National Highways Authority, the United Nations Economic Commission for Africa and the World Bank show that road traffic accidents along the Northern corridor constitute a significant loss of human lives and properties within the region. Road fatalities present a considerable obstacle to the region's aspiration to achieving targets of the UN General Assembly resolution Decade of Action for Road Safety. They also hindered the achievement of goals of the 4th EAC Development Strategy which targeted to have the Road related fatalities reduced by 20% by the year 2015 and to harmonize fatality rates with the African road safety performance target which is to reduce the road related fatalities by 50% by 2030.

Road Safety has therefore become a major challenge for our Northern Corridor region in general. All Northern Corridor Member States are not exempted as road safety has become a big challenge albeit tremendous efforts made in the development and improvement of transport infrastructure.

It is for this reason that the Northern Corridor Transit and Transport Coordination Authority set one of its targets as to "Improve safety on Transport Infrastructure and Facilities" along the Corridor. The NCTTCA identified rigorous interventions that need to be implemented in order to facilitate safer transport across our Member States and support the achievement of the regional developmental goals. Such interventions include among others, the harmonization of the road safety laws, and reduction of risk factors on the NC MS road networks, proper safety data management and effective Road Safety Management System.

In consideration of the above target, during its 46th meeting held in Mombasa, from 4th to 6th February 2019, the NCTTCA Executive Committee directed the Permanent Secretariat “To improve safety in all transport modes”. This directive is reflected in the NCTTCA Strategic Plan 2017-2021 under Infrastructure Program Objective 2.4.

In order to implement the above directive, the NCTTCA Permanent Secretariat conducted mapping of black spots along the Northern Corridor routes in Uganda and Rwanda 7-16 November 2019 following successful conclusion of the same exercise in Kenya 4-8 March 2019. In the three (3) member states of Kenya, Rwanda and Uganda the survey was conducted in collaboration with Ministries in charge of Transport, National Road Authorities, National Road Safety Agencies, Traffic Police, and Transporters’ associations.

The mapping of black spots had put in consideration the concept of Road Side Station (RSS) sites which were mapped along the Corridor. The main objective of RSS is to create rest stations for truck drivers and other travelling public with a view of promoting road safety along the Northern Corridor.

The Concept of RSS is also intended to create designated official parking for all motorists and especially trucks along the corridor hence eliminating unnecessary parking on the highway which has been one of the main causes of accidents along the corridor. Furthermore, the one-stop centre at RSS locations is to accord all road users with well-equipped facilities and opportunities to get rest, check their health, and service their cars, amongst many other services.

Referencing United Nations Economic Commission for African (UNECA) Road Safety Performance Review of Uganda in 2017, the last decade alone saw road crash fatalities rising from 2,597 to 3,503 in 2016 representing a growth of 25.9%. The accident severity index is 24 people killed per 100 road crashes.

In this regard, previous road safety reports on the two countries of Rwanda and Uganda, warrant detailed studies with mind on possible intervention modalities.

The UNECA report asserts that, on average, Uganda loses 10 people per day in road traffic crashes, which is the highest level in East Africa. The overall annual cost of road crashes is currently estimated at approximately UGX 4.4 trillion (\$1.2 billion), representing 5% of Uganda’s gross domestic product (GDP). Although the country has a robust regulatory transport framework in place, various challenges compromise the implementation of such policies and regulations, leading to inefficient service provision.

The entire country and, in particular, Kampala city, is served by an unregulated public transport system, with most of the vehicles in poor mechanical condition, coupled with poor driving skills that contribute to road crashes. Most vehicles operate largely outside the transport regulatory framework. The use of boda-boda system in the cities and along busy routes has also exacerbated the transport safety.

The report acknowledged that road corridors such as the Northern corridor (which is the main route of transit traffic from Kenya to Rwanda and eastern Democratic Republic of Congo) have a poor road safety record and black spots have contributed significantly to this poor performance.

Referencing a report submitted by a Swedish Consulting firm, SWEROAD, in December 2014 on road safety in Rwanda, there were 556 deaths on the accident scene, as officially recorded by Rwanda National Police(RNP) / Transport Road Safety (TRS), and a further 190 deaths in hospitals, according to MoH statistics, in the year 2013. Moreover, RNP/TRS reported 3,731 persons injured in 5,876 road accidents.

The rounded number of 750 fatalities per year puts Rwanda at a level of 7 fatalities per 100,000 population and 40 fatalities per 10,000 motor vehicles.

Rwanda scores significantly better than its neighbouring countries which all show figures in the range of 20-30 fatalities per 100,000 population (according to WHO Global Status on Road Safety, 2015-2018). Strict enforcement of the use of safety belts in cars and the wearing of helmets by motorcycle drivers and passenger greatly contributes to this better performance without any doubt.

However, in terms of fatalities per 10,000 vehicles, Rwanda has a relatively high incidence of fatalities (40) due to a comparatively small motor vehicle fleet; the score is at the same level as Uganda (also around 50), significantly better than Ethiopia (about 70), but way behind European countries like Netherlands and Sweden.

1.2 Objectives of the Survey

The survey of Black Spots pursued the following main objectives;

- i. Identification of black spots along the Northern Corridor routes and analysis of their contributing factors;
- ii. Mapping of major injury and fatalities based black spot pointers;
- iii. Documentation of key safety concerns and policy recommendations from key stakeholders operating along the routes;
- iv. Preparation of regional guidelines on black spots management along the Northern Corridor routes, and;
- v. Finally, advocacy plan for funds mobilization to address safety concerns at priority black spots identified.

1.3 Methodology

The survey was a multi-agencies exercise that involved stakeholders in the transport sector. NCTTCA liaised with Ministries in charge of Transport, Nation Road Authorities, Transport Safety Agencies, Traffic police, and transporters association in Rwanda and Uganda to carry out the exercise. The Secretariat also tapped into the support of Kenya National Highway Authority (KeNHA) and National Transport Safety Agencies (NTSA) to enrich its findings.

In the two countries surveyed, the team liaised with traffic offices to obtain critical points of crashes along the Northern Corridor routes so that they could be prioritized during the road survey.

Based on the pre-existing information gathered from traffic police and other concerned agencies, the team stopped at designated hazardous points to do physical investigation and recorded likely contributing factors to occurrence of crashes. The following information was captured for further analysis:

- Possible contributing factors to the crashes e.g., absence of road marking, geometric design, road surface condition, etc
- Analysis/Diagnosis arrays
- Suggested Recommendations for improvement etc.

Although Rwanda had already identified and prioritised its black spots, ranking of most Hazardous/Black spots along the Northern Corridor routes within the two states will be done again based on the new realities presented by the survey. As a result, a list of locations that had recorded crash frequencies of at least 5.0 will be selected by crash frequency method and subsequently analysed to rank the spots.

As black spot is ranked based on severity of crashes, the following criteria will be put in place to guide the ranking;

- i. Observed crash frequency
- ii. Crash Rate
- iii. Equivalent Property Damage
- iv. Only Index
- v. Percentage composition of type of crash
- vi. Number of fatalities
- vii. Parties involved

1.4 Expected Outcomes

- Identification and analysis of black spots along the Northern Corridor routes in the member states of Rwanda and Uganda;
- Data on accidents rate, accident frequency and severity index is collected & analysed and NCTTCA to start planning for their first Road Safety Data Management System in order to assist member states to make justifiable decisions when implementing road safety interventions;
- Selection of specific countermeasures for the priority black spots in the two member states;
- Upgrade road safety capacity across all departments and urban administrations to improve understanding of the road safety problem; crash injury problems and cost-effective, evidence-based strategies and countermeasures, HIV/AIDS prevention and care within areas of RSS;
- Re-assessing some RSS locations along the route and their inclusion the RSS issues into the national road safety strategy and national health strategy and supporting action plans to RSS as a strategy of improving road safety and health,

1.5 Participants

a) Survey team in both Rwanda and Uganda

S/No.	Name	Institution	Designation
1.	Prof. Lievin Chirhalwirwa	NCTTCA	Director - Infrastructure Development and Management (Team Leader)
2.	Fred Tumwebaze Hunter	NCTTCA	Director - Private Sector
3.	Eng. John Deng Diar Diing	NCTTCA	Deputy Director - Infrastructure Development and Management (Secretary of the Survey Team)
4.	Eng. Monica A. Abonyo	KeNHA	Deputy Director - Highway Safety and Planning
5.	Eng. Christine A. Ogut	NTSA	Deputy Director - Safety Audit and Inspection
6.	Peter Wanyoike	KeNHA	Engineer - Highway Safety and Planning
7.	Noah Kipyegon	NCTTCA/TMEA	Data base analyst
8.	Melap sitati	NCTTCA/TMEA	Statistician

b) Rwanda Team

S/No.	Name	Institution	Designation
1.	Francois Zirikana	MININFRA	Senior Engineer, Safety and Licensing Compliance
2.	Eng. Hadelin Versjus	RTDA	OSBP Specialist and Road Safety Engineer
3.	Thierry NGARAMBE	Transporters association	Coordinator
4.	Mr. Nicodeme	Rwanda National Police	Inspector

c) Uganda Team

S/No.	Name	Institution	Designation
1.	Eng. Sunday Kenneth Kasenene	MoWT	
2.	Eng. Kusiima Michael Kamoga	MoWT	
3.	Sarah Nduhukire	UNRA	Road safety officer, social aspects
4.	Eng. Freddie Lukwago	UNRA	
5.	Dr. Steven Kasiima	Uganda Police Force	Director, Traffic and Road safety directorate
6.	Kinene Byron	Uganda Private Sector Federation	Chairman

1.6 Detailed schedule

The survey started in Rwanda. Three experts from NCTTCA, two resource persons from KeNHA and an expert from NTSA flew to Kigali and then were joined by National Experts to start the survey. the three main National Road networks of the Northern Corridor were inspected namely;

- NR-1 (Kigali-Huye-Akanyaru Haut), towards the border between Rwanda and Burundi
- NR-2 (Kigali-Rubavu) towards the border between Rwanda and DR Congo and
- NR-3 (Kigali-Gatuna) towards the border between Rwanda and Uganda.

All designated locations were assessed and taken into consideration for detailed investigations. The exercise took three days from November 7-9, with successful survey of a total of twenty six (26) black spots in the three National Networks.

On completion, the team was dropped at Gatuna, Rwanda/Uganda border where they were joined by experts from Uganda and continued to carry out the black spots mapping along the following Northern Corridor routes;

- i. Kabaale-Ntungamo-Mbarara-Mpondwe towards the border between Uganda and DR Congo
- ii. Mbarara-Masaka-Kampala
- iii. Kampala-Jinja-Iganga-Malaba towards the border between Uganda and Kenya

The team finalized the Uganda section at the Ugandan/Kenyan border town of Malaba having successfully mapped out one hundred and fifteen (115) black spots and spent a night in Tororo. The team went back to Kampala the next day to catch their flights back to Kenya on the November 17, 2019.

Consultative meetings were held at specific nodes with Traffic Police, County/District authorities and transporters/drivers found on the ground at the selected black spots.

Generally, during the survey, the following assessments were conducted:

- Identification of the entire stretch where crashes occur;
- Notes and photos were taken on the features in the road environment that pose safety hazard to the road users;
- Interview of road side businesses and establishments such as roadside sellers on the cause of accidents along the highways;
- Surveying of possible locations of Road Side stations along the Northern Corridor
- Discussions on possible solutions of enhancing safety at the designated locations and stretches
- Suggested recommendations for improvement

CHAPTER TWO

2. ROAD SAFETY IN THE GLOBAL CONTEXT

2.1. BACKGROUND

Over the years, the United Nations (UN) has been a key player in efforts to improve road safety around the world. The UN General Assembly adopted resolution 64/255 that proclaimed 2011-2020 as the Decade of Action for Road Safety in March 2010. The global goal of the Decade was to stabilize and then reduce the forecasted level of global road fatalities, by increasing activities conducted at national, regional and global levels. The rationale for the Decade was that it provided an opportunity for long-term and coordinated activities in support of regional, national and local road safety. It was adopted at a time when knowledge of the major risk factors as well as effective counter measures had improved considerably. The Decade provided a timeline for action to encourage political and resource commitments both globally and nationally. It was expected that donors would use the Decade as a stimulus to integrating road safety into their assistance programmes. Low-income and middle-income countries were also expected to use it to accelerate the adoption of effective road safety programmes while high-income countries would use it to make progress in improving their road safety performance as well as to share their experiences and knowledge with others.

The UN stepped up its engagement in Road Safety since the proclamation of the Decade. In April 2015, the UN Secretary-General announced the appointment of Jean Todt as his Special Envoy for Road Safety. In November 2015, for only the second time in history, ministers for transport, health and interior and their representatives convened in Brasilia, Brazil to address the global road safety crisis – the first ministerial conference was held in Moscow in 2009. The 2nd Global High-Level Conference on Road Safety defined the urgent measures needed to achieve the 2030 Agenda for Sustainable Development's ambitious target to halve road traffic deaths by the end of 2020. The Conference adopted the “Brasilia Declaration on Road Safety”, to guide action through the end of the UN's Decade of Action for Road Safety 2011-2020 and beyond.

In April 2018, The United Nations Road Safety Trust Fund (UNRSTF) was established with the aim to contribute to two major outcomes, namely assisting UN Member States to substantially curb the number of fatalities and injuries from road traffic crashes; and reduce economic losses resulting from these crashes. Building on best practices and expertise developed through the Decade of Action for Road Safety, the Trust Fund seeks to support concrete actions helping to achieve the

road safety-related targets of the Sustainable Development Goals (SDGs). By being included in the SDGs explicitly, Road Safety is now recognized as a development issue. UN milestones related to the Decade of Action for Road Safety are shown in figure 1.

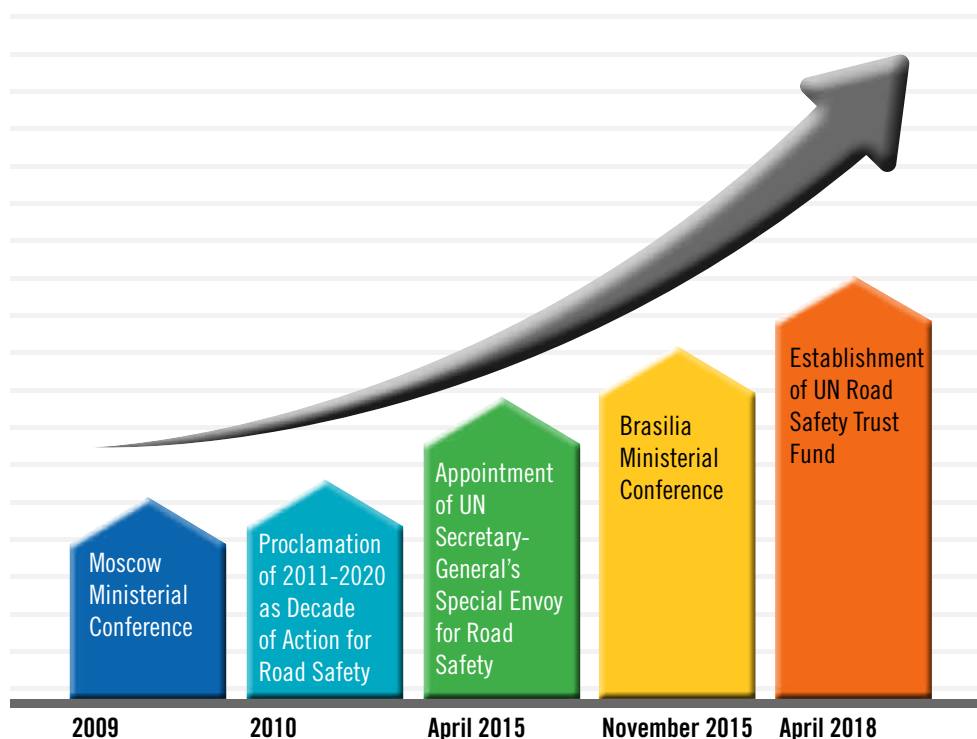


Figure 1: Chronology of Key UN Road Safety Actions

Efforts to improve road safety in Africa started much earlier than in 2010 when the Decade was proclaimed as shown in table 1 below. For instance, the African Regional Road Safety Seminar that was held in Dar es Salaam, Tanzania in July 2009 on the theme “Setting Road Safety Targets: A Way Forward for Reducing Accident Fatalities by Half by 2015” was a milestone in road safety management in Africa as it developed and adopted targets and indicators to help track the implementation of the recommendations of the First African Road Safety Conference that was held in Accra, Ghana in 2007. The seminar was organized as part of a UN project jointly implemented by the five UN Regional Commissions entitled: *Improving Global Road Safety: setting regional and national road traffic casualty reduction targets*. The project was part of efforts to implement the recommendations made in UN General Assembly Resolution A/RES/60/5 on improving global road safety.

Africa was therefore well placed to implement the Decade when it was proclaimed in 2010, as all the elements to prepare an action plan were in place, namely, the expected accomplishments as well as the corresponding targets and indicators. The Second African Road Safety Conference, held in Addis Ababa in November 2011, developed the Action Plan for the Decade by aligning the Accra recommendations and the Dar es Salaam targets and indicators with the 5 Pillars of the Decade. The experts present at the Conference also identified the activities to be implemented under each Pillar and the timeline for their implementation.

The outcome of the Second African Road Safety Conference was submitted to the Second Session of the Conference of African Ministers of Transport that was held in November 2011 in Luanda, Angola. The Ministerial Conference adopted the Luanda Declaration which, among others, endorsed the conclusions of the Second African Road Safety Conference, notably the African Road Safety Action Plan for the Decade 2011-2020 which was also endorsed by the summit of Heads of State and Government of the African Union in Addis Ababa, Ethiopia in 2012. The Luanda Declaration proclaimed the third Sunday of November, which is also the World Day of remembrance of road accident victims, as the African Road Safety Day. In addition, it requested the African Union Commission to formulate the African Road Safety Charter and submit it for adoption by member States of the African Union; and to organize periodic conferences during the Decade to evaluate progress achieved, update the African Action Plan and report to the Conference of Ministers of Transport of the African Union. The draft African Road Safety Charter was adopted at the Third Session of the Conference of African Ministers of Transport that was held in April 2014 in Malabo, Equatorial Guinea and subsequently cleared by African Ministers of Justice and Legal Affairs in 2015 and endorsed by AU Summit in 2016.

Road Safety is an integral part of the Intergovernmental Agreement on the norms and standards of the Trans-African Highways (TAH), initiated by African Ministers of Transport in 2011 in Lusaka and endorsed by Heads of State in 2014 in Malabo. Other achievements worth mentioning include the development of a minimum set of Road Safety indicators and the establishment of an African Continental Road Safety Observatory through a collaborative effort of the African Transport Policy Programme (SSATP), ECA, AUC and other partners. Road Safety Performance Reviews were also completed in Uganda and Cameroon in 2018. In addition, SSATP organised an African Road Safety Forum in Marrakech in 2018.

Table 1: Africa's Response to the Road Safety Crisis: Chronology of Key Road Safety Actions on the Continent

Year	Event
1984	First African Road Safety Congress, Nairobi
1989	Second African Road Safety Congress, Addis Ababa
1997	Third African Road Safety Congress, Pretoria
2007	First African Road Safety Conference, Accra
2009	African Regional Road Safety Seminar, Dar es Salaam
2011	Second African Road Safety Conference, Addis Ababa
2011	Luanda Declaration adopted • Endorsed African Road Safety Action Plan for the Decade 2011-2020 • Proclaimed third Sunday of November as African Road Safety Day.
2012	AU Summit endorses African Road Safety Action Plan for the Decade 2011-2020
2014	African ministers adopt Intergovernmental Agreement on Trans-African Highways, with annex on Road Safety
2015	Third African Road Safety Conference • Roadmap for accelerating implementation of African Road Safety Action Plan (2011-2020) adopted
2016	African Road Safety Charter adopted
2018	• Road Safety Reviews completed in Uganda and Cameroon • Minimum set of Road Safety Indicators developed • African Road Safety Observatory launched
2019	Road Safety Reviews initiated in Ethiopia and Zimbabwe
2019	STC on Transport, Infrastructure, Intercontinental and Interregional Infrastructure, Energy and Tourism (STC-TTIET) recommends AUC and ECA to develop Africa's post-2020 Road Safety Strategy

The UN Decade of Action for Road Safety as well as the implementation of the African Road Safety Action Plan will come to an end in 2020. The review of the status of implementation of the Plan in order to establish the extent to which its objectives have been met and to highlight best practices, challenges and lessons learned in the implementation process was carried out.

The report provided the basis for articulating Africa's post-2020 Road Safety Strategy that is expected to feed into the successor initiative of the Decade of Action for Road Safety at the global level. The African strategy will be informed by Agenda 2063 – Africa's long-term development strategy – as well as global initiatives such as the Sustainable Development Goals and UN Road Safety targets.

2.2. State of Road Safety in the World

According to the World Health Organisation (2018) global status report on road safety, the number of road traffic deaths continues to rise steadily, reaching 1.35 million in 2016. However, the rate of death relative to the size of the world's population has remained constant. When considered in the context of the increasing global population and rapid motorization that has taken place over the same period, this suggests that existing road safety efforts may have mitigated the situation from getting worse. The WHO report contains the following messages:

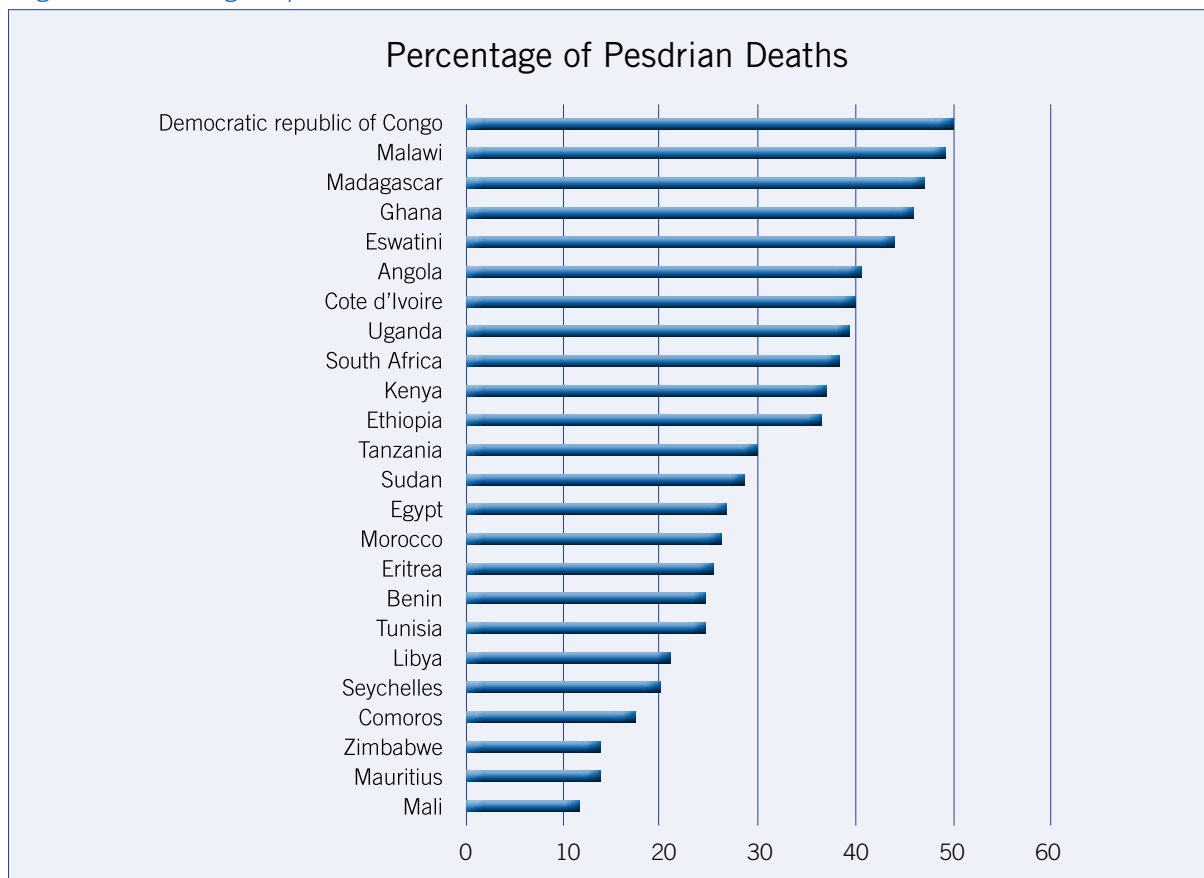
- Road traffic injuries are currently the leading cause of death for children and young adults aged 5–29 years;
- There continues to be a strong association between the risk of a road traffic death and the income level of countries;
- With an average rate of 27.5 deaths per 100,000 population, the risk of a road traffic death is more than three times higher in low-income countries than in high-income countries where the average rate is 8.3 deaths per 100,000 population;
- The burden of road traffic deaths is disproportionately high among low- and middle-income countries in relation to the size of their populations and the number of motor vehicles in circulation;
- There has been more progress in reducing the number of road traffic deaths among middle- and high-income countries than low-income countries. Between 2013 and 2016, no reductions in the number of road traffic deaths were observed in any low-income country, while some reductions were observed in 48 middle- and high-income countries; and
- The number of deaths increased in 104 countries during this period.

Africa continues to have the most dangerous roads in the world, with the risk of death from road traffic injury being highest on the continent (26.6 per 100 000 population), and lowest in Europe (9.3 per 100 000 population). It is worth noting that the global rate of road traffic death is 18.2 per 100,000 population. The rate of road traffic deaths in South-East Asia is 20.7 deaths per 100,000 population while those of the Eastern Mediterranean and Western Pacific regions are 18 and 16.9 deaths per 100,000 population respectively.

Pedestrians and cyclists represent 26 percent of all deaths, while those using motorized two- and three-wheelers comprise another 28 percent. Car occupants make up 29 percent of all deaths and the remaining 17 percent are unidentified road users. Africa has the highest proportion of pedestrian and cyclist mortalities with 44% of deaths.



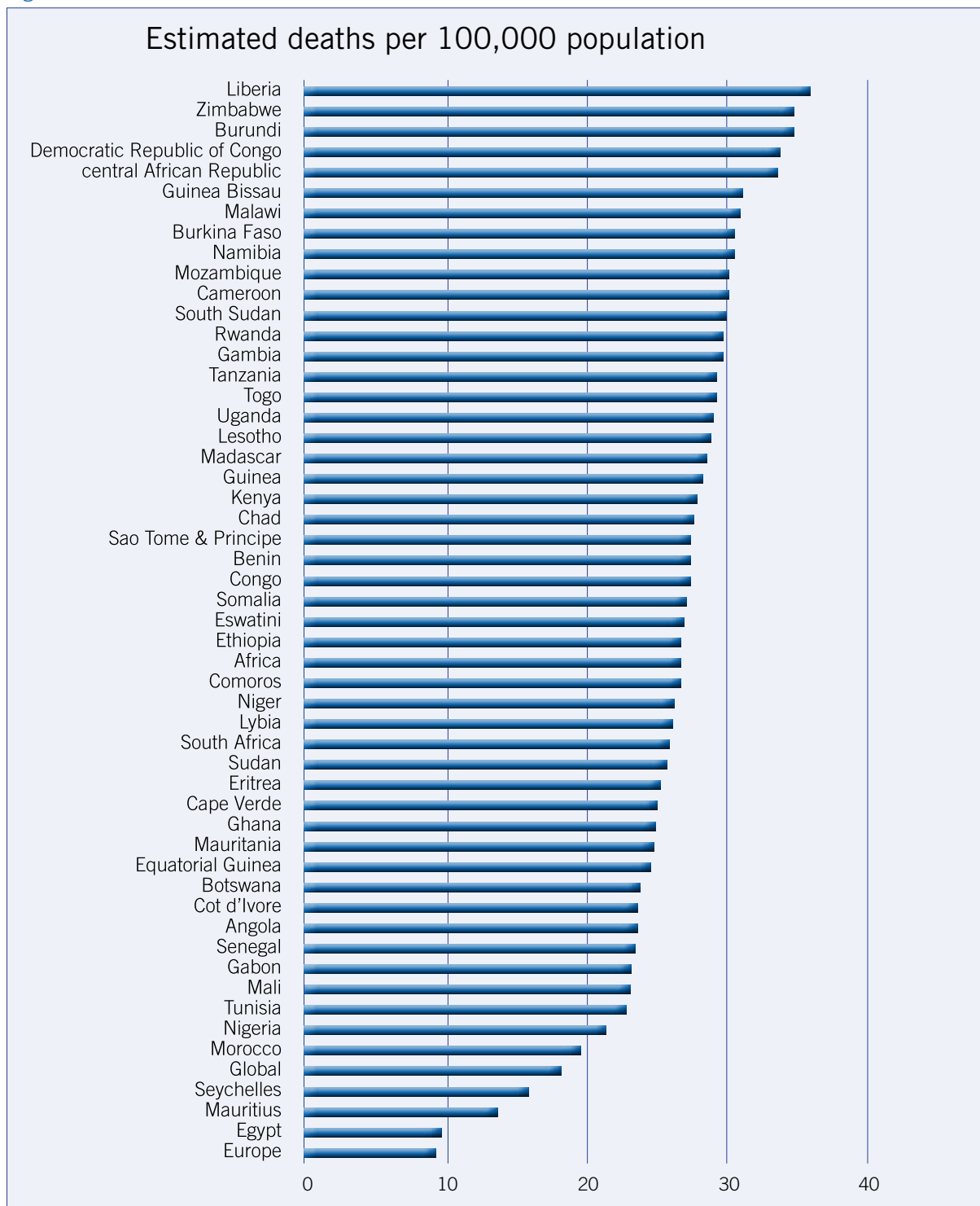
Figure 2: Percentage of pedestrian deaths in selected African countries



Source: Compile by Author from WHO Report (2018)

The following statistics put the enormity of Africa's road safety challenge in proper perspective: the rate of deaths per 100,000 population is higher in all African countries than the European Average of 9.3; the rate of death per 100,000 population in 51 African countries for which data is available is more than double the European average with the exception of Egypt (9.70), Mauritius (13.7), Seychelles (15.9) and Morocco (19.6); and pedestrian deaths represent more than 40% of total road crash deaths in 7 out of 24 African countries (29%) with available data.(figure 3 below). The estimated road traffic death rate per 100,000 people in Sweden that had a total number of registered vehicles of 6.1 million (6,102,914) in 2016 was 2.8 compared to 27.5 deaths per 100,000 people in Benin that had a total number of registered vehicles of only 449,761 in 2016. In other words, Sweden has 13.6 times more registered vehicles than Benin but Benin has 9.8 times more road traffic deaths per 100,000 people than Sweden.

Figure 3: Road crash fatalities in selected African countries



Source: Compile by Author from WHO Report (2018)

2.3. Positive Economic Outlook and Potential Road Safety Implications

Africa experienced an unprecedented and sustained economic growth in the early stages of the implementation of the African Road Safety Action Plan (2011-2020). The continent has also embraced economic transformation as its development agenda, as epitomized by the adoption of Agenda 2063 by the African Union as the blueprint for the continent's long-term development. Many African countries are already implementing medium to long-term development strategies that seek to elevate them from low to middle income status. The continent's GDP growth was 5.7 per cent in 2012 and 4 per cent in 2013 against developing economies' average of 4.6 per cent. In 2013, around half of African countries grew at 5 per cent, a higher share of countries than in 2011 and 2012. Between 2009 and 2013, the top 11 performers in Africa recorded growth of 6.7 per cent or more, with Ethiopia recording the fastest growth at 9.4 per cent a year. All sub-regions in Africa recorded growth in 2018, with East Africa being the fastest growing sub-region. Africa's economic growth slowed slightly from 3.4 percent in 2017 to 3.2 percent in 2018 but is projected to accelerate to 4.1 percent in 2020. This growth was driven by external and internal factors. External drivers included strengthening global demand and moderate increase in commodity prices while the domestic drivers included sustained investment in infrastructure and strong private consumption, along with higher oil production.

Africa's impressive economic growth figures in the past decade, confirms the continent's ability to sustain a positive development trajectory, transform its economy, and become a global growth pole. But this has implications for the safety of the continent's roads. First, the current economic growth in Africa is spurred, at least partly, by infrastructure development – notably the construction of roads. In this regard, spending in Africa's infrastructure grew by 8% between 2011 and 2013 with some countries such as Cape Verde, Namibia, Uganda and South Africa allocating up to 44, 39, 28 and 24 percent of their overall budgets to the sector. Improvement in the quality and coverage – in terms of density and distribution - of Africa's roads, if not accompanied by appropriate and deliberate road safety measures, may have the unintended consequence of increasing road crashes. In essence, improvements in Africa's roads, in line with the transformation agenda, could exacerbate the current bad road safety situation on the continent.

Second, rapid economic growth in Africa is coupled with a growth in the middle class and a rising consumer market. Household final consumption expenditure on the continent grew by 4.1 percent between 2010 and 2017. The number of people in the middle class is projected to grow from about 245 million in 2000 to over 500 million in 2025. Rapid economic growth in African countries has led to a tremendous growth in car ownership, which in turn has increased the risk of crashes on the continent's road, especially in countries that have not improved their traffic management practices. In essence, the rapid increase in car ownership could also exacerbate Africa's bad road safety situation. Table 2 shows huge changes in the number of registered vehicles in African countries during the period of implementation of the African Road Safety Action Plan 2011-2020. Table 4 shows that that number of registered vehicles increased by more than 40 percent between 2013 and 2016 in countries such as Ethiopia, Kenya and Nigeria. Several other countries recorded increases of more than 20 percent during that period.

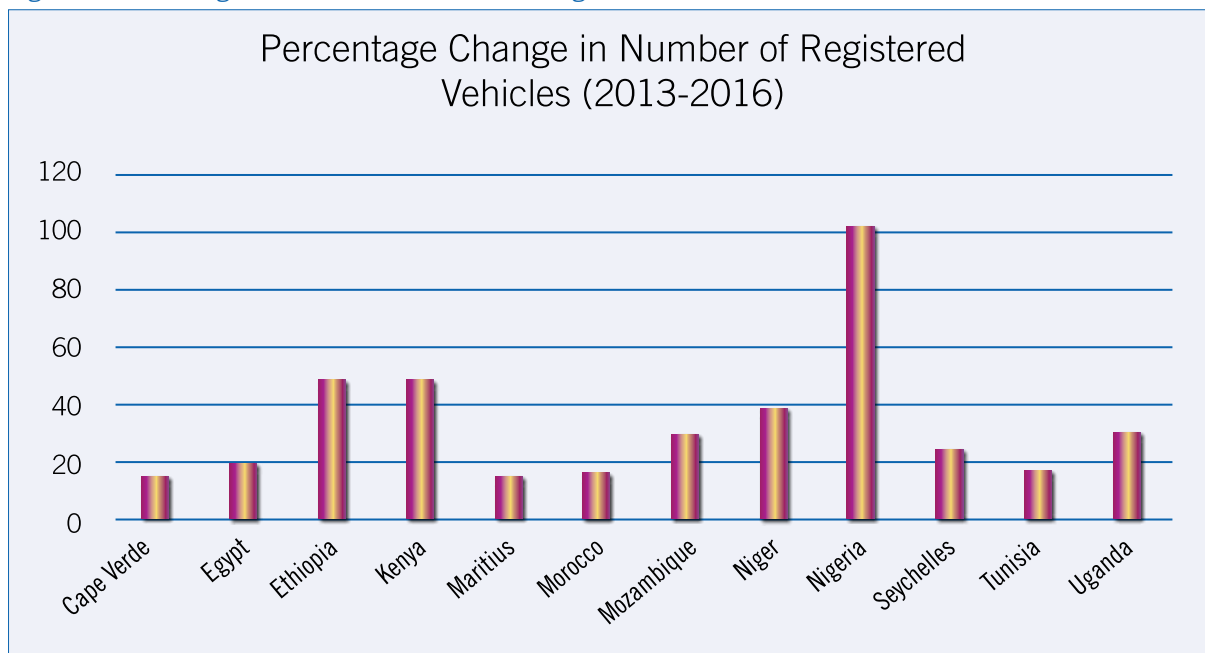
Table 2: Change in the number of registered vehicles in selected African countries

Country	Number Registered Vehicles (2015 WHO Report)	Number of Registered Vehicles (2018 WHO Report)	Change in Number of Registered Vehicles	Percentage Change in Number of Registered Vehicles (%)
Benin	34914 (2013)	469761 (2016)	434847	1245.48
Botswana	520793 (2014)	653274 (1995-2016)	132481	25.44
Burkina Faso	1545903 (2013)	2106292 (2015)	560389	36.25
Cape Verde	56690 (2013)	64955 (2016)	8265	14.58
Central African Republic	37475 (2014)	37475 (2014)	0	0
Chad	622120 (2013)	112400 (2016)	-509720	-81.93
Cote d'Ivoire	594071 (2012)	905537 (2016)	311466	52.43
Egypt	7037954 (2013)	8412673 (2016)	1374719	19.53
Eritrea	70319 (2014)	72405 (2016)	2086	2.97
Ethiopia	478244 (2012/2013)	708416 (2015/2016)	230172	48.13
Gambia	54471 (2005-2013)	84963 (2005-2016)	30492	55.98
Ghana	1532080 (2012)	2066943 (2016)	534863	34.91
Guinea	33943 (2011)	259731 (2016)	225788	665.20
Kenya	2011972 (2013)	2979910 (2016)	967938	48.11
Madagascar	219576 (2013)	236929 (2015)	17353	7.90
Mali	289828 (2013)	344345 (2015)	54517	18.81
Mauritius	443495 (2013)	507676 (2016)	64181	14.47
Morocco	3286421 (2013)	3791469 (2016)	505048	15.37
Mozambique	542336 (2013)	698864 (2016)	156528	28.86
Namibia	280583 (2012)	371281 (2017)	90698	32.32
Niger	315600 (2013)	436420 (2016)	120820	38.28
Nigeria	5791446 (2013)	11733425 (2016)	5941979	102.60
Rwanda	107411 (2012)	180137 (2016)	72726	67.71
Senegal	401910 (2013)	468051 (2015)	66141	16.46
Seychelles	18606 (2013)	23076 (2016)	4470	24.02
Sudan	320974 (2013)	1252740 (2012-2016)	931766	290.29
Togo	58111 (2011)	64118 (2016)	6007	10.34
Tunisia	1735339 (2013)	2015601 (2016)	280262	16.15
Uganda	1228425 (2013)	1594962 (2016)	366537	29.84
Tanzania	1509786 (2014)	2163623 (2016)	653837	43.31
Zimbabwe	927129 (2013)	1198584 (2017)	271455	29.28

Note: Figures in bracket are the corresponding years of the data

Source: Compiled by Author from WHO Global Status Report on Road Safety (2015, 2018)

Figure 4: Percentage Increase in the number of registered vehicles in selected African countries



Source: Prepared by Author from WHO Report (2018)

CHAPTER THREE

3. MODELS FOR BLACK SPOTS IDENTIFICATION, CRASH DATA ANALYSIS AND MANAGEMENT

3.1 Introduction

The identification of road sections characterized by high risk accidents is the first step for any successful road safety management process, considering the limited available resources. Although researchers started to study black spot decades ago, there is no universally applicable definition of what should be regarded as a black spot. It varies from a project or a country to another. According to TRACECA Regional Road Safety Project team that developed Black Spots Management Guidelines in Eastern European Countries, a Black Spot is defined as *“Any location on a road with a maximum length of 300 meters, at which at least four fatal crashes have been recorded during the last three years”*. KeNHA’s Black Spot Management Report, 2018, defines Black Spot as “any location that has a higher number of crashes than other similar locations because of local risk factors which are based on observed or recorded number of crashes in an area and not the expected number of accidents”. The Kenya Traffic Police Department identifies a black spot as “any location that experiences at least five crashes in a given calendar year”. The following terminologies are important in understanding road accidents and black spots.

3.1.1. Collision Frequency

A road section is categorized as a hazardous/black spot if the number of collisions recorded exceeds a threshold number over a specified period. Collision frequency can hence be defined as the number of crashes occurring at a site, facility or network within a one-year period.

3.1.2. Collision Rate

A road section is considered a hazardous/black spot if the collision rate exceeds a set threshold. By definition, collision rate can be described as the number of crashes that occur at a given site during a certain period in relation to a measure of exposure (for instance, per billion vehicle kilometres of travel for a roadway segment). It is thus the probability of a crash occurring per instance of exposure based on past events.

$$\text{Collision Rate, } x = \frac{\text{Average Collisions per year} \times 10^9}{365 \text{ days} \times \text{AADT} \times \text{Length of Scheme under consideration (Km)}}$$

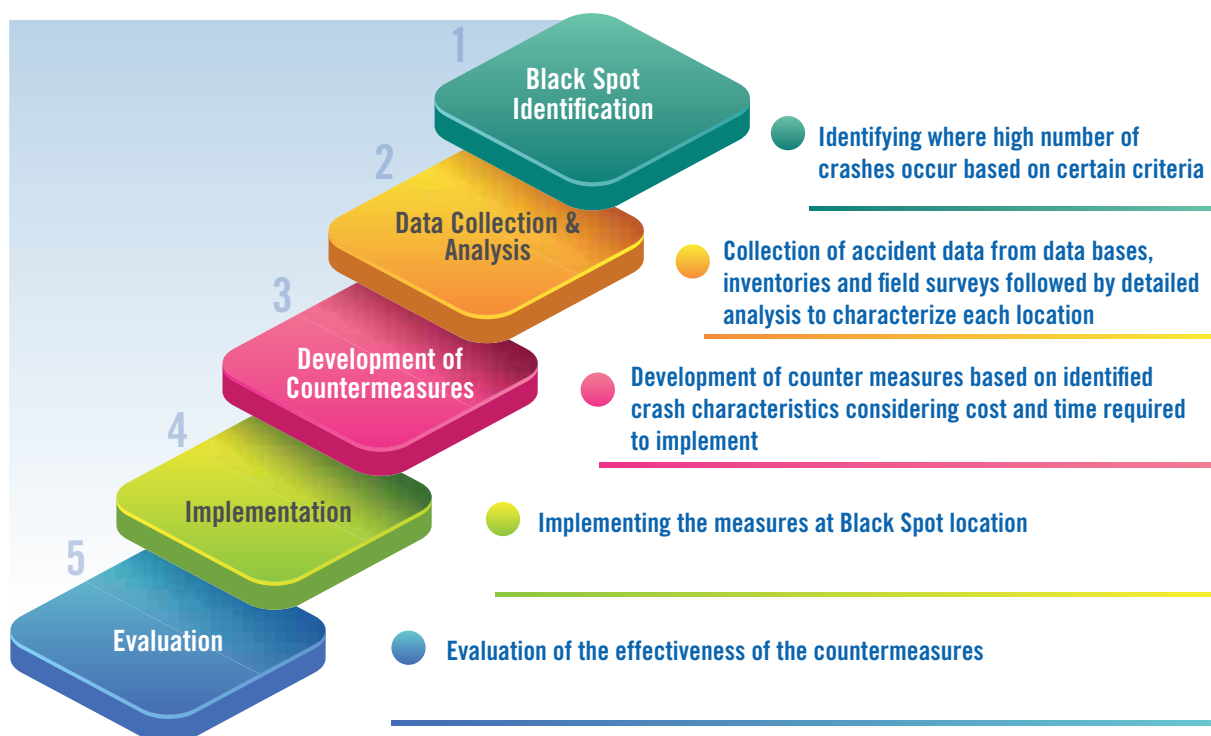
Where AADT – Annual Average Daily Traffic

3.1.3. Collision Severity and Intensity

This criterion attaches a weightage factor that is a function of the worst injury sustained by one of the crash victims. In this regard, for example, a fatal or serious injury crash has a higher weightage factor as compared to a slight injury or a Property Damage Only (PDO) crash. If the number and frequency of fatalities or severe injury crashes at a spot exceeds the threshold, then the location can be considered a hazardous/black spot.

3.2. Crash Data Analysis

The process of Black Spot Management is a crucial process in the mitigation of frequency and severity of crashes on a road network. It involves identification, analysis and development of countermeasures in the remedying of the hazardous locations. Black Spot Management can be summarized in the following steps.



Source: KeNHA Black Spot Management Report, 2018

3.3. Black Spot Identification

This process involves determination of the most hazardous locations within a road network and forms the basis for road safety analysis. As mentioned earlier in this report, the process of black spot identification and mapping involved empirical analysis of surroundings to the hazardous spots which involved taking note of physicals and other inherent factors that might be deemed to be contributing to road crashes. A brainstorming session on possible remedies to the causes of accidents were shared and tabulated.

For the case of Rwanda, there were about twenty six (26) spots identified by a consultant, SweRoad along the NR-1, NR-2 and NR-3 as Black Spots. These spots were subjected to further investigation by the team, recording possible causes of accidents along with possible mitigation measures that would these accidents to a halt.

In the case of Uganda, the team worked with national and regional traffic departments which directed the team to spots whose frequent and severe crashes have been recorded. One hundred and fifteen (115) black spots were identified along the Northern Corridor routes that run from Kabaale through Mbarara to Mpondwe, Mbarara through to Kampala and from Kampala through Jinja to Malaba.

Although the team did not use any specific scientific method, the following methods are currently and widely in use for the purposes of black spots identification.

3.3.1. Sliding Window (SLW) Method

This method of network screening identifies appropriate start and end points of Black Spot locations along the road segments containing homogeneous traffic and similar built-in environment attributes. In the general, it requires a user to input the window length and the critical number of accidents per spot (i.e. critical accidents number, rate, frequency, etc.).

Then, a sliding window moves across the entire road network to identify segments that meet the criteria of crash's threshold. When the criteria is met a BS location is identified, the search for another BS's is continued from the next segment without overlapping. The number of accidents for each SLW (similar in length) is tabulated. Finally, the threshold value is calculated as the average observed number of accidents for all tabulated similar locations with a level of confidence interval. Then the window moves again along the road segments considering any location is unsafe if it's observed number of accidents exceeds the threshold value, as in the following equation (1):

$$xi > \mu + \frac{CI * SD}{n}$$

Where; x_i is the number of crashes at any location (i);

μ is the average number of accidents for all similar locations

CI is a confidence interval (99%, 95%, etc)

SD is the standard deviation

n is the number of all measured locations. The average window length can equal to 0.3 mile according to the Highway Safety Manual (HSM) (AASHTO, 2010)

3.3.2. Spatial Auto-Correlation(SPA)

This method of Black Spot is based on the spatial aggregation of contiguous spatial units (crashes) that are geographically approximate. The assessment of SPA is based on measuring the degree of co-variation between spatial units' values at each location and the nearby location using the global Maron's index I. Positive resulted I index indicate a positive association between variables and a higher co-variation. While, a negative index I means a negative association between variables, and (0) indicates no correlation between the variables. Statistically spatial autocorrelation takes into account simultaneously discrete events' locations and values (attribute similarities) into one index I. The statistical significance of Maron's index I can be calculated using z-score methods. The methodology of SPA for BS is based on the observed number of accidents per hectometre and spatial contiguity matrix, like that;

- Divide the road into small spatial units (polygons = 0.15 miles) and count the number of accidents for each
- Location hectometre as x_i value.
- Calculate the local index I_i for each i location with j values for all other locations. (See Equ. 2)

$$I(i) = Z_i \sum_j w_{ij} Z_j$$

Where: $Z_i = x_i - \bar{x}$, $Z_j = X_{ij} - \bar{x}$ (x here represent the critical number of accidents)

And, $\sum w_{ij} = 1$ (the weight here is row standardization)

The intensity of the dangerousness depends on the value of local Maron's index I_i while the black spot length determination depends on the weight matrix w_i . Therefore, the black zone can be determined for various lengths, and the length also depends on the critical number of accidents for the contingent polygons.

3.3.3. Empirical Bayesian (EB)

Empirical Bayesian method combines both the observed and predicted accidents' frequencies, for a specific roadway network, in one statistical model, using equation below

$$N_E = w * N_p + (1-w) * N_o$$

Where The expected number of crashes (N_E) can be used to estimate the expected average crash frequency for both future and past periods, if only both observed (N_o) and predicted (N_p) number of accidents are available. The weight factor (w) in the equation represent the degree of reliability in obtaining N_p , and it is inversely proportion with its overdispersion parameter that measures the degree of disperse in N_p for the different included study years.

Therefore, if the resulted NP's are more dispersed that will give it a lower weight in the EB equation (3), and vice-versa. However, we can note that the crucial parameter in equation (3), to some extent, is N_p . The predicted average crash frequency (N_p) can be predicted using Safety Performance Function (SPF) for the study period under a given conditions. SPF is a regression equation that estimates the average crash frequency for a given site. The HSM developed a number of SPFs for three different types of road: rural two way two lane, rural multilane highway and urban and suburban arterial.

When calculating SPF, the segmentation is also another crucial issue. The HSM is recommended to use a homogeneous segmentation with a recommended length of 0.3 miles as an average. In our case-study a segment length of 0.6 miles is used, unless the length of the homogeneous section is less than that, in this case the whole length is taken as a one segment. The procedure of identifying BS in EB is based on using excess EB procedures. Firstly SPF for the selected road is calculated using HSM's equation (4), after determining each road segment length (L), AADT and observed number of accidents for each of the study years. Finally, the excess EM is calculated as the difference between NE and NP, where the positive results refer to a black spot road segment.

$$N_p = \exp(a + b * \ln(AADT) + \ln(L))$$

Where: a and b are regression parameters, its value depends on the type of road (number of lane and median type) and type of collision. (Equation 4 is used for urban and suburban arterial road (HSM)).

3.4. Data Collection

Collection and analysis of available crash data is an essential procedure as it provides a better insight on the general issues surrounding and experienced by road users at the time of the crash. Parameters such as general trends, crash severity, causal factors and distribution of parties involved can therefore be deduced from the analysis.

It is however important to note that such analysis procedures need to be initiated and concluded before the field visit and site inspection as they may influence the observations made. The crash data analysis, nonetheless, should be carried to site for reference purposes and to inform discussions between the team members.

The following tools are important for the analysis of collision data:

3.4.1. Accident Data Form (P41 Forms-NTSA)

These are standardized data collection forms that should be filled by the Traffic Police department as and when collisions occur. The date, time and location of the collision is captured in the document. The details of the vehicles, particulars of the drivers involved including their age, sex and if suspected intoxicated are also filled in the form. The severity of injury sustained as well as the position in the vehicle and whether safety belts had been in use at the time of the collision are also recorded. The officer is also expected to capture a pictorial representation of the site of the accident through a sketch plan. Furthermore, the prevailing conditions of the site including the weather, condition of the road surface and other road features should also be filled in the form.

Figure 1. Sample P41 Form from Traffic Police Department (Kenya Traffic Police)

The image shows a sample P41 Accident Report Form from the Kenya Traffic Police Department. The form is titled "The Kenya Police - Traffic Department - Accident Report Form" and includes fields for "Date and Time", "Location", "Vehicle No.", "Driver Name", "Age", "Sex", "Occupation", "Type of Injury", "Severity of Injury", "Position in Vehicle", "Weather", "Road Surface", and "Other Road Features". It also has a section for "Sketch Plan" and "Remarks". The form is numbered 7055 in the top right corner.

3.4.2. Stick Diagram

This is a Road Safety Engineering tool that provides an even more detailed and comprehensive analytical approach to collisions. It consists of two sets of forms which are complementary to each other and are best stored in Microsoft Excel database format. The first form captures on site collision characteristics more or less like the P41 form only that the causation factors and manoeuvre of the parties involved are filled using a scientific methodological approach that assigns different number codes and pictorial representations respectively. Following data collection over a given period of time, the statistics are then translated into a summary form. At this point, it is easier to determine the years, months, days of the week and hours when collisions are most prevalent. Accident patterns and trends for a location over a given duration including severity of the crashes, lighting conditions during their occurrence, road surface characteristics, and distribution of the parties involved and the manoeuvres of the vehicles can therefore be inferred. Ranking of the high-risk locations and the necessary intervention measures can hence be informed from such analytical procedures.

Note: This analysis approach should only be used by persons with appropriate Road Safety Engineering training.

Figure 2. Sample Stick Diagram

[illegible]

3.5. Statistical Tests and Analysis

Additionally, the following Statistical Tests may be used to determine risk rating and probability of collision recurring:

3.5.1. Collision Rate per billion vehicle kilometres

The collision rate for a given roadway segment can be determined using the formula below;

$$\text{Collision Rate, } x = \frac{\text{Average Collisions per year} \times 10^9}{365 \text{ days} \times \text{AADT} \times \text{Length of Scheme under consideration (Km)}}$$

3.5.2. Poisson's Test

This Poisson distribution is used to check a sudden increase or decrease in collision data based on comparison with the long-term average. It is carried out to determine the probability of collisions recurring in a given year by use of the Poisson tables.

3.5.3. Chi-Squared Comparative Test

This test is used to compare characteristics at a particular problem site against the local control data. It is typically used to compare data, for instance, wet and dry, before and after, dark and light; whereby the formula below is used to calculate the chi-squared value:

$$X^2 = \frac{\{ad-bc\}N}{efgh}$$

Where **a** and **b** - site data for the two instances

c and **d** - control data for the two instances

e - Sum of the site data

f - Sum of the control data

g - Sum of data for the first instance

h - Sum of data for the second instance

N - Sum total of the site and control data for the two instances.

Following calculation of the chi-squared value, chi-squared distribution tables are then used to determine the probability level.

Note: Statistical tests and analysis methods, like the stick diagram analysis, require specialized training in Road Safety Engineering for effective use.

3.6. Field Review of the Hazardous/Black Spots

A field visit and site inspection were carried out in twenty six(26) hazardous (black) spots in Rwanda and one hundred and fifteen(115) hazardous spots in Uganda for the purpose of identifying the safety concerns with a view of diagnosing the likely cause of collisions so that appropriate remedial measures would be proposed. The survey team was made up of experts from national road authorities, road safety agencies or departments, transporters associations from the two countries and experts from the Northern Corridor Secretariat and three resource persons from Kenya National Highways Authority (KeNHA) and National Transport Safety Agency (NTSA). It was important to harness the initiatives from the different organizations and integrate their various viewpoints in a bid to develop more effective solutions.

A simplified checklist was adopted for recording of site characteristics and conditions (refer to Appendix). It was thus possible to conduct a comprehensive assessment of the hazardous spots with the survey team members taking the following factors into consideration;

- Features of the road environment, for instance, geometric alignment, junction configuration, road furniture etc;
- Traffic conditions and general road user behaviour;
- Interaction between vehicles and non-motorized traffic including pedestrian crossing habits;
- Previous site conditions that have since been rectified.

Records of the same were thereafter used to generate the survey findings and recommendations. Photographs were also taken during the site visit to act as reference during reporting and also provide any information that might have been overlooked during the actual inspection.

3.7. Development of Countermeasures

Countermeasures can be described as strategies adopted to mitigate or reduce the collision frequency and/or severity for a given location. This procedure is preceded by analysis of crash data and the field visit as the characteristics of each site and crash patterns are clear at this stage. Subsequent development of the countermeasures should however be evaluated from an economic point of view.

In view of budgetary constraints, prioritization of remedial measures is done through application of the Benefit Cost Ratio (BCR) analysis method. The intervention with the highest First Year Rate of Return (FYRR) is preferred:

Benefit Cost Ratio, in principle, assumes that the sum of all positive effects (benefits) of an investment is set against all negative effects (costs). Quantification of the benefits is carried out by converting the estimated change in crash frequency to a monetary value by basing it on societal cost of crashes.

The two countries are, however, yet to establish a basis for determining the societal cost of crashes. Nevertheless, International Road Association Programme (iRAP) proposes two (2) methods that countries should generally apply in estimating the Value of Statistical Life (VSL) namely: -

- i. Human Capital Approach (Lost Output) - Ex post approach: The value of a fatality or serious injury emanating from the crash is attached to the loss in economic value incurred.
- ii. Willingness to Pay - Ex-ante approach: This approach estimates the value that individuals attach to safety improvement by approximating the amount of money that individuals would be prepared to pay to reduce the risk of loss of life.

While causes of road crashes are attributable to human factors, roadway characteristics and vehicle conditions, it is important to note that only the roadway characteristics can be sufficiently addressed by this procedure in mitigating occurrence of crashes at a given location. To guide the implementation framework, countermeasures can further be categorized into three tiers namely; short-term (immediate), intermediate and long-term measures.

3.8. Implementation

After the development of suitable countermeasures for a given hazardous/black spot, the subsequent step involves execution of appropriate remedial works. In light of budgetary constraints occasioned by limited financial resources, interventions with the highest Benefit Cost Ratio should be prioritized on, followed by the other measures identified to address the safety concerns.

3.9. Monitoring and Evaluation

This phase entails periodic assessment of implemented works to evaluate their effectiveness. It requires sound data collection and analysis techniques as well as synergies between key stakeholders in road safety. In addition, regular road safety audits need to be carried out to identify emerging safety concerns. To this end, timely reports should be prepared and submitted to relevant agencies for any further action that might be necessitated.

CHAPTER FOUR

4. SUMMARY OF FINDINGS IN RWANDA AND UGANDA

Following recording of geometric and traffic factors along the surveyed routes of the Northern Corridor in Uganda and Rwanda, peculiar observations were made in respect to the country, routes and regions. The following summarises the findings.

4.1. Findings on Rwandan Roads

Against the projected twenty six (26) predetermined black spots along the main routes of NR-1, NR-2 and NR-3, the team surveyed twenty eight (28) hazardous spots in total having identified two more along Kigali-Gatuna route.

The general observation was that all the main roads in Rwanda are in a well-maintained condition. There were no signs of distressed pavement or failing road shoulders along the routes surveyed.

However, there are challenges observed with the road design parameters. On driving on most roads, it was noticed that some roads had lanes less than generally accepted 3.5m standard. In some cases, road carriageways could go as narrow as 6m; two-lane, two-way. This constriction extends to road shoulders.

As it is generally accepted in East African Highway Design Standards, a road shoulder width is recommended to be 2m. A minimum of 1.5m can be accepted if it is dictated by physical factors or if the road section is in less trafficked area, preferably in rural areas. A clear zone with minimum of 6 m of the road shoulder is recommended to allow for manoeuvrability should there be any surprises to drivers. In most sections of the roads, this provision is missing, more attributable to topographical demand than design failure.

It is recommended that the Ministry of Infrastructure in conjunction with Rwanda Transport Development Agency, check the general specifications of highway elements if this was a mistake of the contractor or if this is attributed to the design standards used during construction to ensure that the lane and shoulder widths are in conformity with regional standards.

Another observation is about challenging geophysical factors. Rwanda being a highly winding terrain presents enormous challenges to road designers and users alike. As most roads wind through continuous vertically and horizontally changing alignments, no amount of safety provision in any ordinary design can curb dangers than come with unforgiving accidents.

It was evident that the government and the people of Rwanda have done and still are doing their best to curb possibility of accidents through strict enforcement and general discipline among the public and specifically road users. At the design level, although it is very expensive, the ministry of Infrastructure and Rwanda Transport Development Agency (RTDA) have provided ad hoc measures to save lives. The risk of veering off and falling into the cliff of valleys that surround most roads have been limited by providing Concrete chevrons as barriers to stop tipping vehicles. It was evident that this provisions worked in saving lives as it could be seen from crashes on the barriers by veering trucks or vehicles. However, most of the barriers used, except at Mudahakanirwa turn along Kigali-Gatuna road, are 0.8 m high which is considered too low for such a demanding terrain.

It is therefore recommended that, concrete shevrone of 1.2 m high and 0.6 m base width be used along all the spots that are deemed precariously dangerous along Rwanda.

Although this provision very expensive, it is recommended that the government of Rwanda makes an institutional plan to produce the barriers at commercially affordable rates since they appear to be among the most effective ways of preventing unforgiving accidents.

It is also that, these be provided along any road whose clear zone is less 6m for the purpose of safeguarding any dangerous tip over.

4.2. Findings on Ugandan Roads

The survey took the team from Kaabale at the border of Rwanda through Mbarara to Mpondwe at the border of Democratic Republic of the Congo. And then from Mbarara through Masaka, Kampala and Jinja to Malaba at Uganda/Kenyan border. Because there were no predetermined black spots, the team undertook general mapping of hazardous spots which totalled to 115.

The general observation was that, all the road network at western part of the country was in good condition except at some stretches from Mbarara to Kasese-Mpondwe junction and around Lakes Edward and George.

On the other hand, the road section that runs from Kampala through Jinja to Busia/Malaba junction is mostly characterised by distressed pavement, worn out road shoulders and ages and overgrown clear zones.

The roads in Uganda are generally designed to acceptable standards and are at motorable state especially at the western region. However, the main problem facing this part of the country on roads is insufficient enforcement and absence of road safety awareness.

The most intransigent road safety problems, come from unsafe driving and unsafe use of roadside space by communities and trading centres dwellers.

Most motorists on Ugandan roads overspeed and overtake even when speed limits are provided for by the signage and markings. This has oftentimes led to crashes at trading centres and at turns

where speed controls are necessitated. Speed rumbles, road signs and road markings seem to be making no much impact on how drivers and riders behave.

The recommended intervention to this dangerous trend is to invest in public awareness campaigns and improved enforcement by the government agencies. Also necessary is improvement of road signage and markings as means of traffic control.

Moreover; structured regular training of drivers on road safety by transporters associations may need to be instituted by the government as a way of instilling disciplines into the road users and drivers.

Another trendy concern is the use of roadside space as Evening Open Air Markets at most trading centres. This has contributed to most pedestrian crashes as overspeeding motorists run through these markets. Sometimes, trucks veer off and run into roadside vendors causing inexpressible loss of lives like the famous case of Rwahi Open Market Accident in 2018.

It is recommended that, apart from conducting public awareness, the government of Uganda especially, Uganda National Roads Authority in collaboration with the local governments, and with the support of development agencies, should regulate establishment of Open Air Markets at minimum of 100m off the main roads to safeguard roadside vendors from wandering onto dangerous highways and also from being crashed by veering truckers.

On the Eastern side of Uganda, especially between Kampala and Jinja, the road is characterized by distressed pavement, worn out road edges and shoulders and overgrown clear zones. The section is also defined by many valleys combined with sharp horizontal alignments with no proper provision for climbing lanes. These factors have compounded to constriction of motorable carriageways and frequency of blind spots which often lead to heads-on and single-involving accidents.

It is therefore recommended that this section of the road be rehabilitated with sufficient provision for clear zones and climbing lanes. In the short term, targeted repair of completely worn out sections and roadside clearances can be used to arrest frequent accidents.

Although the terrain is fair from Jinja through Iganga to Busia junction, failure of pavement, absence of speed calming measures and insufficient signage and road markings, are common phenomena that are attributed to most dangerous crashes. Rehabilitation of this section of the road with sufficient provision for pedestrian utilities and speed calming measure at the centres and along the road, will to a great extent mollify frequent occurrences of road crashes.

In conclusion, most issues that relate to road safety in Uganda can be addressed if and when the Government in collaboration with development agencies and the Northern Corridor Transit and Transport Coordination Authority, work to educate public on road safety and enforce road safety regulations in the country. Uganda National Road Authority can assuage road safety situation by responding to regular replacement and placement of road furniture. It will also be useful if regular roadside clearance is conducted to maintain minimum safe stopping sight distances (SSSD) along all the Northern Corridor routes.

5. ANNEXES: OBSERVATIONS, ANALYSIS AND RECOMMENDATIONS

5.1. Annex 1: Matrix of Findings and Recommendations on the Ugandan Road Network:

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
Katuna-Kabaale-Ntungamo-Mbarara					
1.	Nyakasharara (12Km from Katuna)  <i>Dangerous combination of horizontal and vertical curves merging at a trading centre</i>	12	- Sharp combination of horizontal and vertical alignments merging at a trading center - Roadside market draws people along the highway in the evenings - Speed calming measures (rumble strips) are provided but far from hazardous spot. - No sharp curve ahead and speed limit signs - Accidents recorded are mainly fatal involving crossing pedestrians due to over speeding vehicles 70% of people killed are pedestrians	- Vehicles/ drivers mainly heavy goods vehicles from Kabaale to Katuna fail to negotiate the sharp curve/ corner at the shopping Centre leading to pedestrian deaths. - The sharp curve/ corner is in a built-up area.	- Provision of a designated pedestrian crossing facility - Installation of enhanced road signage to limit approach speeds and warn motorists of the dangerous sharp curve - Enhanced road user sensitization and enforcement of safety by relevant agencies - Installation of speed cameras to monitor travel speeds - Provision of off-road truck run away ramps/sand arrester beds for vehicles that veer off at the curve - Provision of streetlights to illuminate the area at night - Designation of shopping spot off the road at a safe distance away from the road to decongest the road area

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
2.	Kabaraga (67Km to Ntungamo)  <i>Sharp curve likely to lead to loss of control for descending motorists</i>		- Sharp horizontal curve on a descent towards Kabale town. A section of the road has an island separating the directions of traffic - Base deformation/heaving due to soil subsidence on some sections of the left lane from Kabale to Ntungamo - Missing road signs - Missing reflective studs on the inner side of the guard rails - Missing chevrons/directional arrow signs at the sharp curves, damaged bollards on the traffic islands separating directions of traffic - Risky culvert inlet ditch - Missing speed limit signs	- Single fatal accidents due to veering of over speeding vehicles. - No warning signage i.e. sharp curve ahead, speed limit signs - Vehicles/ drivers heading to Kabale fail to negotiate sharp curve/corner.	- Separation of the two directions of traffic using kerbstone (traffic islands) to avoid head on collisions - Speed calming measures be put in place i.e. Rumble strips/ humps to slow down descending traffic - Installation of directional arrow signs/chevron signs to warn motorists on the sharp change of direction. - Installation of speed limit, sharp curve ahead warning signage. - Installation of reflective studs on the carriage way and on guard rails for reflectivity at night. - Installation of speed cameras enforcement of speed limits (50kph) by Traffic Police. - Installation of gantry road signs cautioning motorists against freewheeling and urging them to engage low gears on the descents

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Kakatunda (47Km to Ntungamo)  <i>Relatively built up area along a straight stretch with significant cross road movements</i>		- One of the coldest places in the area, fog in the morning hours a common occurrence - A straight stretch of about 1Km with a good sight distance - Built-up area with several schools - One primary school & 2 secondary schools and health centers. No designated pedestrian crossings have been provided - Missing/vandalized speed limit signs - The area is always foggy (misty) during early morning hours - Presence of police has helped to reduce on the frequency of accidents	- Overspeeding vehicles through the trading center the main cause of pedestrian knock downs - Foggy pavement surfaces cause motorists to skid and overturn - Accidents are predominantly single (overturning) due to reckless driving at night, poor visibility and over speeding	- Provide designated pedestrian crossing points along the centre (raised pedestrian crossings/table tops are more desirable as they double up as speed calming measures) - Reinstatement of speed limit signs and installation of pedestrian crossing signs - Enhanced road user sensitization drives and enforcement of safety - Installation of speed cameras to monitor travel speeds - Provision of streetlights (solar powered) to illuminate the centre at night and when visibility is low due to fog - Installation of informative signs cautioning motorists to proceed with caution due to fog/mist

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
4.	Nyakanengo (44Km to Ntungamo)  <i>Gently rolling terrain that is marred by visibility problems due to fog/mist</i>		• A rolling terrain section • The area is usually foggy/misty during early morning hours • Most pedestrians knocked are drunkards • Accidents are mainly head-on collision and single (overturning) due to poor visibility and over speeding	• Visibility problems mainly occasioned by fog the main cause of head-on and single accidents	• Enhanced driver training, sensitization and enforcement • Installation of advance warning and informative signs cautioning motorists to proceed with caution due to fog/mist • Provision of streetlights (solar powered) to illuminate the centre • Installation of speed cameras to monitor travel speeds • Application of fresh retro-reflective road marking and delineator road studs to mark the lane extents.
5.	Rwahi Town 		• Sharp long curve on a steep slope • Daily road side market (onions market) characterized by hawkers continuously making cross road movements to sell their goods to travelers • Defective brakes make some vehicles lose control resulting in accidents	• Predominant accidents are fatal involving pedestrians, motorcycle riders, pedal cyclists and roadside traders	• Provide designated pedestrian crossing facilities at the town (raised pedestrian crossings/table tops are more desirable) • Enhanced road signage i.e pedestrian crossing signs, junction ahead signs etc • Enhanced road user sensitization and enforcement of safety by ensuring vehicles are inspected

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
			- Speed limit signs are provided but are not observed by drivers - No pedestrian crossing facilities are in place - Dangerously located junction to Ishaka Bushenyi with no provision for speed change (acceleration and deceleration) lanes		- Installation of reflective studs on the inner side of the guard rails - Provide lane separation features such as kerbstone along the town and approaches and install humps/rumble strips to the descending lanes - Improve the existing junction through provision of acceleration and deceleration lanes - Provision of a designated open-air market area off the road - In the long term, consider provision of service lanes with controlled accesses along towns and major centres
6.	Nyabugando (33Km to Ntungamo)  <i>Dangerously oriented access on the RHS with insufficient visibility splays for motorists joining the main highway</i>		- The road is at a lower level while drivers speed to join the highway heading to Kabale - Rolling terrain - Side road with eroded gravel pavement lower than the highway level - No resting space for the vehicles joining the highway - No provision for acceleration and deceleration lanes at the access - Missing road signs	- Accidents occur due to insufficient visibility splays as drivers try to join the highway - Crashes mainly involve commercial vehicles collecting agricultural produce from the access	- Improve the junction by raising the eroded gravel pavement to provide enough resting space for vehicles joining the highway - Provide acceleration and deceleration lanes - Redesign the junction to provide for resting area for joining traffic - Installation of enhanced road signs including Give Way signs on the access road and junction ahead signs on the main highway.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Omungyenyi/Kyamugashe  <i>Accumulation of silt and debris on the carriageway due to clogged access culverts</i>		- Blocked drainage system due to poor maintenance that has led to heaping of silt and debris carried by rain runoff to the highway hence causing obstruction - Presence of floods during rainy season - Small culvert that can't contain the flow of water	- Soil erosion into the highway due to blockage of drainage and waterway. - As a result, silt has accumulated on the carriageway constricting the available motorable width	- Immediate cleaning/unclogging of the drainage system - Provision of cut off drains on the upstream side - Sustained routine maintenance - Install road signs to indicate sharp curves - Enhance driver sensitization/training and enforcement of safety (spot checks) - In the long term, consider raising the road as it is on a low-lying area and to separate it from the existing waterway
8.	Nyamitanga-Isingiro Junction with Kabale-Mbarara Highway (2km from Mbarara)  <i>Insufficient turning radii and missing speed change lanes at the junction</i>		- Narrow Side road junction joined to the blind sharp curve - Lack of enough waiting space for the vehicles joining the highway - Insufficient turning radius at the junction hence turning vehicles occupy outer lanes causing side swipe collisions	Medium and heavy goods vehicles mainly carrying agricultural produce tend to overturn while descending towards the junction	- Enhance road signage at the junction i.e Give Way/Stop signage from the access road and Junction Ahead signs on the main highway - Enhance driver sensitization and training to encourage safe road user behaviour - Re-designing and improvement of the junction to provide for adequate turning radii and speed change (acceleration and deceleration) lanes - Clearing of vegetation and establishments near the junction to increase visibility splays

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
Mbarara-Bushenyi-Ishaka-Mpondwe					
1.	Kagango Market (Kabwohe) (26Km from Mbarara)  <i>Market vendors have encroached into the road reserve. No designated crossing points are in place along the stretch</i>		• Straight stretch on a flat terrain • Daily road side market (3 months old at the time of the survey) close to the road • No pedestrian crossing facilities have been provided for • No speed limit signage despite Traffic Police ensuring that speed limit is 50 Km on the stretch	• Accidents mainly involve pedestrians and people chasing grasshoppers ending up on the road • Accidents mainly attributable to reckless driving/overspeeding and pedestrians accessing the live carriageway heedless of traffic	• Provision of appropriate road signs • Installation of speed humps and rumble strips to lower approach speeds to the market centre • Provision of designated pedestrian crossings for safe cross road movements (raised pedestrian crossings/table tops are more desirable as they also act as speed calming measures) • Application of retro-reflective road marking on the road and installation of delineator road studs • Relocation of the market beyond the road reserve • Develop a policy for all developments along the roads

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
2.	Nyamufumula  <i>Sharp curve with obstructed sight distances</i>		- Blind curve on rolling terrain - Transition problems from a horizontal to a vertical curve - The carriageway width at the curve is 6m and shoulder width is 0.8m - Visibility for the descending vehicles is obstructed by trees which are too close to the road - Road marking is faded; the continuous yellow centerline is barely visible - Siltation on the road edges narrowing the effective carriageway	All categories of vehicles (trucks and small cars) are involved in accidents due to speed from upside, lack of street lights and visibility	- Provision of appropriate warning signs and additional speed calming measures (rumble strips) on the approaches to the sharp curve - Clearing of the trees within the road reserve/trimming of overgrown twigs to enhance sight distances - Widen the road (to at least 3.5m lane widths) and provide adequate curve radius - Application of retro-reflective road marking on the road and installation of delineator road studs - Review the geometric design to ensure a smooth transition of horizontal and vertical curves - Routine maintenance of the road including regular de-siltation

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Kitojo (Sheema district) (35Km from Mbarara) 		- A steep slope connecting a small sag and crest curve - There is a seasonal market that operates every after two weeks - Existing humps which were provided to reduce speed have become a hazard to the ascending trucks which fail and decelerate backwards hence overturning - Side road junction located midway along the slope and lacks accelerating and decelerating lanes - Deteriorated road edges and faded road marking	- Accidents are mainly caused by over speeding, reckless driving and failure of heavy trucks to ascend steep horizontal alignment - Slowly climbing heavy trucks block the road leading to unwarranted overtaking by small vehicles, causing head-on or single accidents	- Provide appropriate road signs (speed limit and sharp curve ahead signage) - Improve on the existing humps - Repair of the deteriorated edges and application of appropriate road marking - Enhance road user sensitization and driver training - Widen the road to provide for a climbing lane - Review the geometric design to reduce the crest and sag curves - Redesign the side road junction to provide adequate turning radius including acceleration and deceleration lanes - Consider installation of speed cameras as long term mitigation measure
4.	Bushenyi Town 		- Distressed pavement - Narrowed carriageway - Absence of parking facilities for motorcyclists and Public Service Vehicles	Absence of parking facilities and narrow road leads to frequent accidents	- Provision of parking facilities and expansion of carriageway to provide enough space for traffic maneuverability - Rehabilitation and widening of the carriageway to at least 3.5m lane widths

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
5.	Ishaka Junction with Mitooma & Kagamba Road 		- Due to land conflict, the stage has been move from the gazetted parking to its current location - Loading Taxis and Buses park on the road shoulders and part of the carriageway hence narrowing the highway - Careless driving - Lack of designated pedestrian facilities across the main highway - Faded road marking - Deteriorating road surface (potholes and worn out shoulders) especially as you proceed towards Mpondwe	- Congestion at the roadside because of loading and off-loading of trucks causes pedestrians crashes - Accidents involve pedestrians, students, motorists and <i>bodaboda</i> riders. - Side impact and head on collisions common at the location - Political issue involving the bus bays beyond the Municipality capacity	- The municipal council should ensure that all vehicles load and offload from gazetted parks - Enhance sensitization to all road users and enforcement of safety - Remove the parking from the road shoulders and ensure it is well relocated - Provide designated pedestrian crossings across the main highway on either side of the junction (raised pedestrian crossings/table tops are more desirable) - Application of retro-reflective road marking and delineator road studs - Rehabilitation of the deteriorating pavement - In the long term, consider provision of service lanes with controlled access and separate NMT facilities at the town or constructing a bypass for through traffic

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Ishaka Town 		- Road edges have are worn out leading to narrow traffic carriageway - Absence of designated parking facilities for motorcyclists	- Narrow carriageway causes opposing traffic to collide or brush their bodies - Unregulated motorcycle activities leads to frequent accidents involving the motorcyclists and highway traffic	- Rehabilitation and expanding of the carriageway to provide ample space for motorists maneuver - Provision of designated parking for the motorcyclists and other Public Service Traffic
8.	Butare Trading Centre  <i>Cross junction at the road which is already under construction is responsible for side impact crashes</i>		- Busy developed area with multiple accesses hence the need for service lanes with controlled access to the main road - There is tea factory in the area that generates heavy vehicles traffic - Cross road junction responsible for many side impact collisions - The road is under rehabilitation but the design could not be ascertained to know how safety was considered - Inadequate work zone signage and temporary traffic management plans	- Accidents are mainly due to motorcyclists entering and exiting the highway recklessly and heedless of other traffic (unsafe road user behavior) - The work zone also needs to be managed better through enhanced signage and control of traffic to allow for safe passage within the town	- Since the road in under rehabilitation, there is need to look at the design and find out how safety was considered mostly on: - NMT and pedestrian crossing facilities - Junction design improvement (i.e. consider staggering the accesses at the junction and channelizing the intersection) - Provision of parking facilities for both motorcyclists and PSVs and service lanes with controlled access to the main road - Enhance sensitization to all road users and enforcement of safe road user behaviour - Enhanced temporary work zone signage and control of traffic to avert any possible incidents

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
9.	Nkombe  <i>Sharp curve on a steep descent</i>		- Steep slopes with combined curves on rolling to mountainous terrain - Sharp corner likely to cause loss of control leading to run off collisions - Accidents are mainly caused by over speeding and reckless driving (police issued 128 penalty tickets to reckless drivers in one month) - Drivers use free gear on steep slopes which results in loss of vehicle control	Predominant crashes are mainly run off involving heavy goods vehicles	- Since the road is under rehabilitation, there is need to look at the design and find out how safety was considered mostly on: - Lane separation (separation of the two directions of traffic using a central median might be necessitated) - Provision of climbing lanes - Road signs and speed calming humps/rumble strips - Consider installation of informative signage cautioning motorists against freewheeling and urging them to engage low gears during descent - Installation of directional arrow/chevron signs at the tight curve - Enhance sensitization to all road users and enforcement of safety
10.	Lake Nkunge in Rutoto District  <i>Sharp curve next to the lake with limited sight distances</i>		- Sharp curve around lake Nkugute - Accidents are due to over speeding and reckless overtaking - Dead bodies are thrown in the lake		- Provide appropriate road signs (speed limit and sharp curve ahead) - Enhance road user sensitization and driver training - Provide adequate curve radius - Install speed cameras to monitor speed

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
11.	Parkview				
12.	Kyambura Market Centre  <i>Wreckage of a fuel tanker that was involved in a catastrophic run off accident</i>  <i>Extremely sharp curve at the market centre with no provision for safety fences on high embankment</i>		• Sharp combined curves on rolling-mountainous terrain • Built-up area with a daily market • The road is under rehabilitation and this particular section has been sealed but a climbing lane and lane separation have not been considered • This is the exact location where over 22 people perished in August 2019 when a fuel tanker got an accident • Side road to Katerera at midway curve • Missing safety fences and directional arrow signs as you descend down the stretch • Inadequate warning signage and speed calming measures	• The stretch traverses a hilly terrain with successive combinations of horizontal and vertical curves	• Provide appropriate road signs along the stretch (speed limit and sharp curve ahead warning signs) • Provide pedestrian crossing facilities for safe cross road movements within the market • Installation of safety fences (flex beam guardrails with reflective studs) and directional arrow (chevron) signs at the tight curves • Enhance sensitization to all road users and enforcement of safety • Review the design to consider: - Lane separation with central medians - Speed calming humps and rumble strips to the descending lane - Provision of climbing lanes - Redesign the RHS side junction to provide adequate turning radius and speed change (acceleration and deceleration) lanes

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
13.	Katunguru (Kazinga Channel Bridge) -located at the separation of Lake George and Lake Edward  <i>Gaping hole on the middle of the bridge deck carriageway</i>  <i>Pothole ridden bridge approach with missing hazard marker signs</i>		- The Bridge is damaged on the Kyambura side approach (bridge deck failure has left a gaping hole in the middle of the carriageway) resulting into a black spot - The bridge handles huge volumes of traffic of taxis, trucks and buses on a daily basis hence paralyzing traffic - Narrow carriageway with pothole ridden approaches on the Kyambura approach - Missing/non-reflective hazard marker signs on the bridge approaches	The portal frame bridge crosses the channel joining Lake George and Lake Edward	- During the survey UNRA decided to close Katunguru Bridge, which connects Kasese and Rubirizi districts, after it got damaged. - Kasese road traffic was therefore diverted to allow for remedial works - Consider rehabilitating the approaches to rid them of potholes - Installation of bridge ahead and hazard marker signs - In the long term, consider widening the bridge and provision of pedestrian walkways

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
15.	Kikorongo (47Km to Mpondwe) Junction with Ishaka -Kasese Road 		- Need for speed restrictions for vehicles approaching the T-Junction especially from Mpondwe - Need for speed limit and Stop signs at the junction	The recently completed T-junction has been channeled for safe passage of traffic	- Provide appropriate road signs (speed limit signs on the approach to the T-Junction, Stop and Give Way signs) - Limit the speed towards the junction in the form of speed calming rumble strips - Application of retro-reflective road marking on the recently completed junction
16.	Rusheshe (13Km to Mpondwe) 		- Seasonal River crossing - Size of the cross drain (culvert) is inadequate - The river is silted and narrow at the culvert inlet - Heavy runoff from the mountains carry debris that blocks the culvert hence the road	- Vehicles don't cross the road at this point during heavy rains due to flash floods - There is river sand mining at this point by the locals and as a result, the people mining sand block the culvert intentionally thus causing flooding	- Sand mining should be stopped/relocated immediately - Desilt the cross culvert and the river inlet and outlet drain - Ensure routine maintenance is carried out - Enhance sensitization and enforcement of safety - Carry out "River Training" works

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
Mbarara-Lyantode-Masaka-Kampala					
1.	Makenke (3km from Mbarara towards Masaka)  <i>Unclogging of the access culvert due to blockage by debris and tree stumps from the upstream</i> Dangerously oriented kerbstone adjacent to the live carriageway		- Carriageway is higher than the shoulder - Bodaboda riders hit the floor on the side and fall in the road where they are knocked by moving vehicles - Bus stop bays on both sides are narrow (i.e. parked vehicles occupy part of the carriageway) and poorly designed leaving no space for the cyclists transiting from the shoulder to carriageway - The provided pedestrian walkway has encroached on the road shoulders - No pedestrian crossing facilities - No speed limit signage	- Motorcyclists tend to climb up the kerbstone due to absence/ inadequacy of road shoulders - Accidents mainly involve pedestrians' cyclists transiting from shoulders to carriageway at bus stops	- Provide appropriate road signs - Provide pedestrian crossing facilities - Redesign and reconstruct the bus stop bays to allow for adequate stopping - Removal of the current pavement - Provide smooth transition to carriageway from the shoulder for cyclists

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
2.	Koranorya Market Area  <i>Access to Koranorya Daily Market. Note the significant cross road movements by pedestrians due to the roadside establishments</i>		- The area is known for its huge number of accidents in the whole country - Straight stretch of about 1Km in a very busy built-up area including a daily market - No pedestrian crossing facilities Pedestrians and riders are hit while crossing to the market - Road markings give the drivers freedom of overtaking - No speed limit signs - No designated stopping areas on both sides hence vehicles park on the road shoulders occupying part of the carriageway - Side road junction lacks accelerating and decelerating lanes - Accidents happen both day and night times	Double parking (both sides) is common during the night due to stoppages by truckers on transit effectively narrowing the road	- Provide appropriate road signs - Provide designated pedestrian crossing (raised pedestrian crossings/table tops are more desirable as they double up as speed calming measures) - Provide speed limits along the area - Provide traffic calming measures - Enhance sensitization to all road users and enforcement of safety - Redesign the side road junction to Koranorya market to provide for adequate turning radius and speed change (acceleration and deceleration) lanes - Provide designated parking areas (elongated lay bys) on either side of the road as well as designated bus bays - In the long term, consider provision of service lanes with controlled access to the main road

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Kalungi Farm after Biharwe 		- Sharp horizontal curve into a crest curve - No center line markings only edge markings are visible hence drivers tend to overtake causing accidents - Speeding motorists and dangerous overtaking are common at the location	Run off and head on collisions are possible at the location	- Provide retro-reflective continuous center line marking in addition to delineator road studs - Re-application of thermoplastic paint on the edge lines - Enhanced road signage warning motorists accordingly
4.	Kibeega  <i>Faded centre line marking at a dangerous curve</i>		- Missing advance warning signage to indicate the presence of a junction - Missing Stop/Give Way signage on the minor road - Drivers entering and exiting to the minor road arbitrarily responsible for a number of crashes - Blind corners at a crest - Side Road to Kiruhura at the crest of the vertical curve - Road marking along the location completely faded - Rugged road shoulders - No road signs both on the highway and minor side road	Motorists exiting to or joining from the gravel access heedless of other traffic causes the location to be a hazardous spot	- Application of retroreflective road marking (including a continuous yellow centre line at the location) and delineator road studs - Installation of Junction Ahead signs on either side of the location - Installation of Stop/Give Way signage on the minor road - Redesign the side road junction to provide adequate turning radius and speed change (acceleration and deceleration) lanes - Rehabilitation of the deteriorated road edges - Need of maintenance of the road side and clearing of the roadside bushes to increase visibility splays - In the long term, consider improvement of the vertical curve to improve on the sight distances

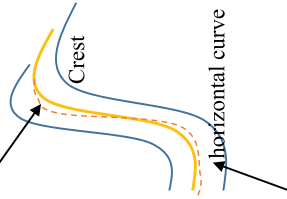
S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
5.	Kyapa Trading Centre  <i>Centre is located on a blind curve from the Masaka side. Access on the RHS also lacks proper speed change lanes</i>		- The location has been declared very dangerous by traffic Police - Built-up area (trading center) on a rolling terrain with a blind corner - No pedestrian crossing facilities - Road markings are faded - No road signs - Vehicles park on the road on either side due to lack of designated parking areas - Accidents mainly are due to over speeding and reckless driving	- Over speeding vehicles cause frequent crashes involving pedestrians and motorcycles. - According to traffic Police, this location is #2 in terms of prioritization	- Application of retroreflective road marking (including a continuous yellow centre line at the location) and delineator road studs - Provide appropriate road signs (speed limit and advance warning signs) - Provide pedestrian crossing facilities for safe cross road movements by pedestrians - Provide speed calming facilities on the approaches to the centre - Rehabilitation of the deteriorating road edges and improvement of the RHS access to provide for speed change lanes - Enhance sensitization to all road users and enforcement of safety - Consider provision of streetlights to illuminate the centre at night.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
6.	Kyabazala village also known as Lyantonde rural (1Km to Lyantonde)  <i>Relatively straight and gently sloping stretch prompts motorists to overspeed and overtake dangerously</i>		- It is a straight and gently sloping section of the road which encourages motor vehicles overspeeding - It has insufficient signage for speed limit and warning of incoming traffic from community road. Hence Vehicles hit humps and overturn - The road markings are visible but not reflective at night - Side road junction leading to two (2) schools with insufficient turning radius	Most of the accidents are head-on and roll-over occurring at night due to over speeding coupled with invisible markings	- Provide appropriate Road signs and relocate the existing speed limit signs to match the area development - Need of a speed limit (e.g. 50 Km) signage at the crest - Repaint the road markings with approved reflective paint and install delineator studs to the center and edge line markings - Enhance sensitization to all road users and enforcement of safety - Redesign the LHS side road junction to provide adequate turning radius and speed change (acceleration and deceleration) lanes - Consider installation of streetlights to illuminate the stretch at night

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Karegero Trading Centre (68Km to Masaka) <i>RHS access lacks necessary speed change lanes with shoulders being rugged</i> <i>Centre lacks designated pedestrian crossings and road markings are faded</i> 		- Built-up area (trading center) on a rolling terrain - The location is a notorious hazardous spot known for near daily accidents which involve children - No provision for pedestrian crossings - No road signs - Road markings are faded - Eroded shoulders at a side road junction cause the vehicles joining the highway to delay at the junction	Reckless driving and over speeding responsible for most pedestrian knockdowns	- Provide appropriate Road signs - Repaint the road markings with approved reflective paint and install delineator studs to the center and edge line markings - Provide designated pedestrian crossing facilities for safe crossing movements - Enhance sensitization to all road users and enforcement of safety - Repair of the eroded shoulders - Redesign the RHS side junction to provide adequate turning radius and speed change (acceleration and deceleration) lanes

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
8.	Bugamba – Malongo known as “Killer” 		- Long stretch of about 2km with sharp succession of horizontal curves on a very steep descent (rolling-mountainous terrain) - Over speeding and dangerous overtaking common - No advance warning road signs - Faded road markings - No climbing lane hence drivers tend to overtake slow moving vehicles on steep ascent - The safety fences are damaged due to impact by vehicles that lose control - Freewheeling by truckers at the location likely	- Crashes mainly involve Masaka bound heavy goods vehicles which fail to negotiate the sharp succession of curves - Predominant type of accidents: run off and head on collisions. In 2001 such accident resulted in 30 deaths on the spot	- Consider provision of the following gantry type road signs: - No Freewheeling (Engage low gears) - No Overtaking - Observe Lane Discipline - Enhanced advance warning signs on the sharp dangerous curves - Speed calming measures at the beginning of the descent (rumble strips and speed limits) - Enhance sensitization to all road users and enforcement of safety - Reinstatement of the damaged guardrails to offer restraint during emergencies - Provide off-road truck run away ramps/sand arrester beds for vehicles that veer off at the curves - Operationalizing motor vehicle inspection centres In the long term consider: - Dualing the section/ separation of the traffic directions using a central island - Widening the carriageway and provision of climbing lanes for ascending traffic - Re-design/realignment of the section to eliminate the sharp curves.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
9.	Kamutuza Village 		- Climbing lanes provided but head-on collisions occur at the termination of climbing lanes - Road is properly marked - No road signs - Overspeeding, dangerous overtaking and general lane indiscipline responsible for majority of the crashes - Missing directional arrow (chevron) signs	- Fatal single accidents due to loss of control are common at the location - A horizontal curve is located at the trough of a vertical curve	- Provide appropriate road signs (speed limit and directional arrow signs at the trough of the horizontal curve) - Installation of delineator road studs to mark the lane extents - Enhance sensitization to all road users and enforcement of safety - Review the design and markings
10.	Kvojja-Kaganda village 		- Road wide enough with climbing lanes to the Masaka direction - Priority is given on steep ascent - Road markings are clearly visible - Provision for overtaking extends to blind corner - Knocked down safety fence on the LHS - Overspeeding, dangerous overtaking and general lane indiscipline are all likely - No road signs - Missing road studs especially at the tight curves	Accidents are mainly due to trucks losing control as a result of over speeding and reckless driving	- Provide appropriate road signs (speed limit and sharp curve ahead signs) - Enhance sensitization to all road users and enforcement of safety - Reinstatement of the damaged guardrails (with reflective studs on the inner side) to offer restraint during emergencies - Installation of delineator road studs to mark the lane extents especially at tight curves - Review of the road marking to prevent overtaking at blind corners

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
11.	Kyangoma 		- Provision for overtaking has been extended to a crest with limited sight distances - Type of accidents mainly fatal head-on collisions - Missing/vandalized road signs	Overtaking priority at the crest  Overtaking priority at the corner	- Provide appropriate road signs (speed limit and sharp curve ahead signs) - Enhance sensitization to all road users and enforcement of safety - Review of the road marking to prevent overtaking at blind corners and curves
12.	Nkoni Shopping Centre 		- Relatively busy centre with schools, a church and roadside establishments hence many pedestrians - Straight section on a relatively flat terrain with a side road junction - Missing road signs - Overspeeding and dangerous overtaking common - Faded edge line markings and missing road studs	- Accidents involve pedestrians, school going children and motorcyclists - Predominant crashes are hit and run	- Provide speed limit signs on the approaches to the centre and pedestrian/children crossing warning signs - Provide designated pedestrian crossings for safe crossing movements - Enhance sensitization to all road users and enforcement of safety especially in restricting overtaking - Improve the side road junction - Installation of delineator road studs to mark the lane extents

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
13.	Kyabakuza (about 3Km to Masaka)  <i>Completely faded marking on the carriageway and speed humps</i>		- Built-up busy town with multiple road side businesses - Stopover for most of Mbarara bound vehicles - No gazetted parking facilities for PSVs hence irregular parking on the shoulders - Road marking is completely faded, the speed humps are not visible from a distance as a result - Missing speed hump signage	The centre is on a descent and pedestrian knock downs are likely due to the multiple crossing movements	- Application of retroreflective road marking and installation of delineator road studs - Repaint the speed humps and crossing points with retro-reflective paint - Provide appropriate road signs (speed humps ahead warning signs) - Provide speed restrictions (speed limit signs) - Enhance sensitization to all road users and enforcement of safety - Provide designated bus stop bays on either side the road - In the long term, consider provision of service lanes to the town
14.	Ssaza (2Km from Masaka town)  <i>Accesses located near the crest of a horizontal curve with no speed restrictions in place</i>		- Crossroad to Buganda Land Board at a trough on a rolling terrain - Built-up area with a lot of social activities, many schools, etc. - Being on the crest of a vertical curve, sight distances are impaired - No speed limits are in place - No pedestrian crossings - Deteriorating road edges/rugged shoulders - Accidents are mainly fatal involving all road users due to over speeding and reckless driving	- Vehicles using the accesses tend to cut across main carriageway traffic at a bend creating a safety hazard - Side impact collisions are therefore common at the location - Pedestrian knockdowns are also common	- Installation of appropriate advance warning signs (pedestrian crossings and junction ahead signage) - Provision of pedestrian crossings at a safe distance from the blind spot (raised pedestrian crossings/table tops are more desirable at the location) - Provide speed restrictions (speed limit signs) - Repair of the deteriorating shoulders - Sensitization of road users and enforcement of safety - Redesign the junction to create a staggered intersection

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
15.	Kyakumpi  <i>Accesses to main carriageway traffic just after a bend</i>		- Staggered intersection with multiple accesses consisting of side roads with inadequate turning radius at the beginning of a steep ascent - Absence of road markings - Insufficient signage especially at the feeder roads/accesses to the main highway signage - Humps are provided to reduce speed - Junctions have no storage and weaving lanes - Damaged guardrails at the curve	- Accidents mainly involve incoming traffic from the feeder roads - Accidents at the location involve all road users –pedestrians, motorcycles and vehicles	- Application of retroreflective road marking (emphasis on a continuous centre line to restrict overtaking) and installation of delineator road studs - Provide appropriate road signs (speed limit, junction ahead and pedestrian crossing warning signs) - Installation of Stop/Give Way signs at the accesses joining the main road - Reinstatement of the damaged safety fences - Enhance sensitization to all road users and enforcement of safety - Junction improvement at the access roads to allow for speed change lanes as well as weaving/storage lanes on the main highway - As a long term measure, consider service lanes with controlled accesses

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
16.	Matanga Shopping Centre  <i>Steep ascent towards Matanga tends to prove difficult for ascending HGVs</i>		- Built-up area on Rolling terrain with a Crossroad - Accidents are due to collision of overtaking vehicles as trucks fail to ascent and small vehicles try to overtake. This ends up in head-on collision - Crossing vehicles collide with others on the highway - The road is wide with shoulders of about 2.5m either side; a provision for a climbing lane has however not been made - No parking space provided hence vehicles park on the road - Vandalized road signs - Visible road markings	Heavy trucks experience difficulties ascending, overtaking vehicles tend to collide head on with descending traffic	- Reconfigure the road marking (to do away with the wide shoulders/reduce the shoulder widths) and create a provision for climbing lanes - Provision of appropriate road signs - Sensitization to all road users and enforcement of safety - Redesign the junction to create a staggered intersection - Being a trading centre, provide parking space for taxis and designated bus stops.
17.	Kamutuza  <i>Both climbing lanes at a vertical crest with limited sight distances</i>		- Descending vehicles have the freedom to overtake as a result of poor road markings - Limited sight distances at the vertical crest from either side - Speeding motorists, dangerous overtaking	Accidents occur at climbing lane termination point due to overspeeding and absence of proper markings and signage	- Provide appropriate road signs (consider informative signs cautioning against overtaking and urging motorists to observe lane discipline) - Enhance sensitization to all road users and enforcement of safety - Reconfigure the road markings to prohibit descending vehicles from overtaking

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
18.	Mukoko (Lukaya)  <i>Road marking allows Kampala bound traffic to overtake on sections with limited sight distances</i>		- Rolling terrain high speed section - Road marks are clear - Overtaking road markings extend to the middle of the ascent limiting the driver's sight distance	- Accidents are due to over speeding and reckless driving - Overtaking line misused by drivers	- Enhance sensitization to all road users and enforcement of safety (overspeeding and reckless overtaking the main concerns at the location) - Prohibit overtaking by providing a solid center line reflective marking with studs - Reconfigure the road markings with a focus on safety notwithstanding sight distance at the stretch
19.	Lukaya Town  <i>Lack of designated pedestrian crossings. Note the faded edge line markings</i>		- Important trading centre - Very Busy town where truck drivers park to rest mostly at night (serves as a road side station) - Weighbridge located along the stretch - Trucks park on either side of the highway narrowing the carriage way due to lack of designated parking - Faded edge line markings	Accidents occur due constriction of carriageway by stopping trucks and heightened pedestrian activities.	- Provide designated pedestrian crossing (raised pedestrian crossings/table tops are more desirable to calm speeds) - Provide appropriate road signs - Reinstate the humps and rumble strips - Application of retroreflective road marking and installation of delineator road studs - Enhance sensitization to all road users and enforcement of safety (vendors to be also restricted from main carriageway)

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Missing designated bus bays and parking facilities</i>		- No parking lanes and bus stops - Humps are worn out - Road markings are worn out - Inadequate provision pedestrian facilities (e.g. crossings and walkways) - Uncontrolled access to the main highway		- Provision of street lights to illuminate the town - Provision of designated parking spaces and bus stops. - Consider provision of a roadside station with amenities near the town - In the long term, consider provision of service lanes with controlled access
20.	Lwera swamp (91 km to Kampala from Masaka) 		- Flat terrain section with roadside fish vendors - Drivers park along the road on either side narrowing the carriageway to buy fish - Pavement deformation at the culvert crossing which creates an uneven surface - Section is characterized of seasonal bush burning and the smoke affects visibility	- Most of accidents involve roadside vendors and overspeeding vehicles - Seasonal bush fire present danger to traffic and other road users.	- Immediate repair of the depression on the pavement is required - Provide appropriate road signs - Reinstate the faded road markings - Routine maintenance of the road - Provision of guardrails along the swamp to prevent vehicles from running off the road during emergencies - Enhance sensitization to all road users and enforcement of safety - Provide gazetted parking places for drivers buying fish.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
21.	Buyaya 		• New Shell fuel station on the RHS close to the road along the curve • Vehicles from the main road enter the fuel station use the designated exit and vice versa, which leads to accidents • No road signs • Overtaking common despite presence of a continuous yellow centre line • No protection along the swamp	• Motorists sometimes fail to observe entry and exit points to the newly developed service/petrol station causing accidents	• Provide road signs informing motorists on the station ahead • Provision of speed calm measures in the form of rumble strips on the approaches to the station • Enhance sensitization to all road users and enforcement of safety • Consider provision of acceleration and deceleration lanes at the entry and exit preferably to be implemented by the fuel station • In addition, redesign the section to include storage and weaving lanes to allow for turning movements into and out of the station
22.	Mbizinya 		• Rolling terrain section with a climbing lane of about 400m which terminates in a crest • Accidents are mainly head-on collisions due to careless driving and overtaking descending vehicles	• Road in good condition and wide enough with climbing lanes on the LHS • Speeding and dangerous overtaking however need to be curbed to avert future accidents	• Provide appropriate road signs (beginning and end of climbing lanes) • Enhance sensitization to all road users and enforcement of safety • Reconfigure the road markings to prohibit descending vehicles from overtaking

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
23.	Kalandazi  <i>Faded climbing lane marking</i>		- Rolling terrain section with a climbing lane - Accidents are mainly head-on collisions due to overtaking descending vehicles - Road markings of climbing lanes are faded - Centre line road marking allows descending motorists to overtake	The climbing lane marking needs	- Provide appropriate road signs (beginning and end of climbing lanes) - Application of retroreflective marking to clearly demarcate the climbing lane and the installation of delineator road studs to mark the lane extents - Enhance sensitization to all road users and enforcement of safety - Reconfigure the road markings to prohibit descending vehicles from overtaking
24.	Kikunyu (Kamengo) 		- High speed section from Kampala with a blind corner. - Road markings give priority to overtake at the corner while there is a market ahead - Accidents caused by over speeding and recklessness - Type of accidents: hit and run & head-on collision. - All categories of accidents at this black spot: minor, serious and fatal	Predominant accidents are mainly hit and run involving pedestrians as well as head on collisions	- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Reconfigure the road markings to prohibit descending Masaka bound vehicles from overtaking

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
25.	Kampiringisa 		- Accidents are mainly due to over speeding and recklessness of the drivers - Faded road markings (edge line markings) - Missing delineator road studs	- A catastrophic accident that killed 23 people occurred at the location - Overspeeding and dangerous overtaking need to be curbed to avert future accidents	- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Install speed cameras for speed monitoring - Application of road marking (edge line markings) and installation of delineator road studs
26.	Mpambire Swamp 		- Straight stretch - Faded road markings - Most of accidents are head-on collisions	Accidents are mainly due to over speeding and recklessness of the drivers at the straight section of the road with proper road marking to guide the vehicles	- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Application of road marking (edge line markings) and installation of delineator road studs - Consider reinstating and extending the guardrails to restrain errant motorists in the event of an emergency - Install speed cameras for speed monitoring

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
27.	Nakirebe (Near Gasline Petrol Station) 		• Straight stretch terminating into curves on a rolling-flat terrain • Built-up high speeding area with a fuel station close to the road	• Most accidents are head-on and rear end for vehicles joining the highway from and to the fuel station because of lack maneuverability lane by fueling trucks	• Provision of a 50kph speed limit sign and informative sign on the fuel station ahead • Enhance sensitization to all road users and enforcement of safety especially in regard to overspeeding and overtaking dangerously • Reconfigure the road markings to prohibit overtaking • Consider provision of acceleration and deceleration lanes at the entry and exit preferably to be implemented by the fuel station • In addition, redesign the section to include storage and weaving lanes to allow for turning movements into and out of the station

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
			Kampala-Jinja-Iganga-Malaba: 14th & 15th November 2019		
1.	Namanve (Near Rwenzori Bottling Company)  <i>Pothole on the LHS lane. Note the deteriorated edges and faded road marking</i>		• Straight section on a gentle sag curve • Road shoulders and part of the carriageway are eroded • The road is under rehabilitation • No road signs • No road markings	• Most accidents are serious to fatal caused by over speeding and reckless overtaking coupled with narrow carriage way and no road furniture	• Widening and rehabilitation of the carriageway (Dualling at the section would be more preferable owing to the traffic volumes) • Provision of NMT facilities along the stretch including cycle tracks and pedestrian walkways • Provide appropriate road signs (speed limit signs etc) • Application of retro-reflective road marking and installation of delineator road studs • Improvement of the access to Rwenzori Bottling Company (complete with speed change lanes) • Provision of streetlights to illuminate the stretch • Enhance sensitization to all road users and enforcement of safety

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
2.	Seeta – Bagala (Victory Church) 		• Road shoulders and part of the carriageway are eroded resulting to a narrow carriageway with no shoulders • The road is under rehabilitation • No road signs • No road markings • Missing safety fences adjacent to the swamp • Heavy traffic volumes especially during peak hours		• Provide appropriate road signs • Enhance sensitization to all road users and enforcement of safety • Application of retro-reflective road marking and installation of delineator road studs • Redesign the road markings to prohibit overtaking • Provide speed restrictions • Widening and rehabilitation of the carriageway (Dualing at the section would be more preferable owing to the traffic volumes) • Installation of safety fences
3.	Seeta High School 		• Road shoulders and part of the carriageway are eroded resulting to a narrow carriageway • Need for a climbing lane • Road under rehabilitation • Faded road marking		• Widening and rehabilitation of the carriageway (Dualing at the section would be more preferable owing to the traffic volumes) • Application of retro-reflective road marking and installation of delineator road studs • Redesign the road markings to prohibit overtaking • Provision of NMT facilities along the stretch including cycle tracks and pedestrian walkways • Provide appropriate road signs • Provide speed restrictions • Provision of streetlights to illuminate the stretch

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
4.	Kigombya  <i>Faded road marking at the RHS junction</i>		- Built-up area that requires a dual carriageway to separate traffic - No pedestrian crossing facilities - No road signs - No road markings		- Provide appropriate road signs (Junction Ahead and speed limit signs) - Application of retro-reflective road marking and installation of delineator road studs - Redesign the road markings to prohibit overtaking - Channelization of the RHS junction and provision of speed change lanes - Widening and rehabilitation of the carriageway (Dualling at the section would be more preferable owing to the traffic volumes) - Provision of NMT facilities along the stretch including cycle tracks, pedestrian walkways and designated crossing points - Provision of streetlights to illuminate the stretch - Provision of service lanes with controlled access in future

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
5.	ABACUS –Mbalala 		• Straight section connecting two blind curves • Faded road markings • No road signs • Accidents are roll-ons on either direction due to over speeding and reckless overtaking while avoiding head-on collisions		• Provide appropriate road signs • Reestablish the road markings • Provide a solid centerline marking to prohibit overtaking • Widening/dualing of the road to enhance its capacity • Provide speed restrictions • Provide safety fences (guard rails) on either side • Enhance sensitization to all road users and enforcement of safety
6.	Forest Hill  <i>Overgrown twigs on the RHS jutting into the carriageway obstructing sight distances</i>		• Rolling terrain section with a short sag curve and a crest • High speeding zone that prompts drivers to recklessly overtake • No road markings • Overgrown vegetation • Accidents are mostly fatal due to over speeding and overtaking		• Provide appropriate road signs • Re-establish the road markings • Provide a solid centerline marking to prohibit overtaking • Provide speed restrictions • Clearing of overgrown vegetation to improve sight distances • Enhance sensitization to all road users and enforcement of safety

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Kayanja towards town		- No road markings - Industrial area with a lot of people and pedestrians moving to and from work - No pedestrian facilities - Accidents are fatal due to over speeding and reckless driving		- Provide appropriate road signs - Reestablish the road markings - Provide a solid centerline marking to prohibit overtaking - Provide pedestrian crossing and NMT facilities - Provide speed restrictions - Redesign the section to include Pedestrian walkways
8.	Kayanja Town		- Busy built-up town and vehicles park/stop on the road narrowing the carriageway - No road markings - No pedestrian facilities - No road signs - Accidents are mostly fatal head-on collisions due to over speeding and reckless driving		- Provide appropriate road signs - Provide speed restrictions - Reestablish the road markings - Provide a solid centerline marking to prohibit overtaking - Provide pedestrian crossing and NMT facilities - Provision of streetlights to illuminate the town - Enhance sensitization to all road users and enforcement of safety - Redesign the section to provide parking or service lane

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
9.	Namagongongo (Kikondo) 		- Curved section on a rolling-flat terrain prone to high speeds - No road markings - Climbing lane has been provided for though not clearly marked - No road signs - Accidents are mostly due to overtaking and reckless driving		- Provide appropriate road signs - Re-establish the road markings - Application of road marking to mark the climbing lane - Provide a solid centerline marking to prohibit overtaking - Provide speed restrictions
10.	Kasaku Tea Estate		- Rolling terrain section with a climbing lane - Accidents are mainly head-on collisions due to overtaking at a climbing lane - No road markings - No road signs		- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Application of appropriate road marking and delineator road studs - Provide road markings to prohibit descending vehicles from overtaking
11.	Tembo (Steel works)		- Sharp curve on a rolling terrain - No road signs - No road markings - Accidents are mostly fatal and head-on		- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Provide road markings to prohibit overtaking

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
12.	Kitega – Lugazi 		- Built-up area with two opposite washing bays on each side of the road - Eroded shoulders and part of the carriageway due to poor maintenance - Serious/ fatal accidents - Accidents are mainly head-on collisions due to overtaking - Speed limit signs in place; they however do not extend beyond the car washes		- Provide appropriate road signs and extend the speed limits to cover the car wash area - Enhance sensitization to all road users and enforcement of safety - Application of retro-reflective road marking and installation of delineator road studs - Improvement of the drainage system especially at the entrances to the car washes - Carry out routine maintenance (regular desilting of the road edges) - Widen the roadway
13.	Kawolo Hospital  <i>Relatively dangerous curve near the hospital that is prone to overspeeding and reckless overtaking</i>		- Rolling terrain stretch with a climbing lane connecting two blind curves - No road signs - Faded road markings - Blind corners either side - Road marking are faded on climbing lanes (extents and length of the climbing lane not clearly defined) - Numerous Fatal and Serious Accidents mainly head-on due to careless driving - Limited visibility due to lack of maintenance for vegetation along the highway		- Provide appropriate road signs/replace defaced signs - Enhance sensitization to all road users and enforcement of safety - Provide road markings to prohibit overtaking - Application of road marking to define the lengths and extents of the climbing lane - Maintenance of the road side by clearing bushes and vegetation within the road reserve

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
14.	Buryantete  <i>Heavy trucks washing area on the LHS</i> 		- Steep ascent with a climbing lane which has developed potholes - No road markings - Presence of heavy trucks washing area on the LHS - Visibility affected by overgrown bush and cane plantation in the road reserve - Road markings give priority to descending vehicles to overtake		- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Provide road markings to prohibit descending vehicles from overtaking - Carry out bush clearing and ensure routine maintenance - Engage owners of cane plantations not to use the road reserve - Designation of a proper heavy vehicles washing facility at a safe distance from the live carriageway
15.	Sagazi 		- A rolling section terminating in a blind curve and sag curve - Presence of a market - Climbing lanes from the vertical trough - Overspeeding and failure to observe lane discipline a safety concern - Faded road markings - No road signs - Bus stop located close to a sag curve (poorly located)	Horizontal curve at the trough of the vertical curve makes the location susceptible to dangerous driving	- Provide appropriate road signs - Enhance sensitization to all road users and enforcement of safety - Application of road marking to mark lane extents and clearly define the climbing lanes - Provide road markings to prohibit descending vehicles from overtaking - Redesign and relocate the bus stop to a safer location

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
16.	Rwankiima (Place of Monkeys) Mabira forest 		- Faded road markings hence drivers overtake any how since the prohibition markings are not visible - Numerous Fatal and Serious Accidents mainly head-on due to over speeding and overtaking - Motorists lack discipline as they compete for lanes - Limited visibility due to trees (forest) protruding into the carriageway - Pitch darkness at night	Traffic police has mentioned this stretch as one of the most dangerous section in the country	- Provide enhanced retro-reflective road signs warning motorists accordingly - Enhance sensitization to all road users and enforcement of safety - Application of road marking to mark lane extents with special emphasis on continuous yellow centreline to prohibit overtaking at dangerous spots - Installation of delineator road studs along the forest - Provide street lights
17.	Najjembe – Mabira forest  <i>Missing bus bays at Najjembe centre</i>		- Trading centre - Very busy daily road side market with many road side vendors where most travelers stop to buy eats - No clearly defined parking areas hence vehicles park on the road - No road markings - No pedestrian crossing facilities		- Provide appropriate road signs (speed limits on to the centre, pedestrian crossing signs etc) - Need to widen the road - Provide a designated pedestrian crossing at the centre - Application of road marking to mark lane extents - Provide a solid centerline marking to prohibit overtaking - Limit access to the carriageway and provide service lanes - Redesign the section to provide for temporary lay bys and designated bus bays for PSVs

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
18.	Kinoni - Mabira forest 		- Long steep ascent with no climbing lane - Overgrown bush in the embankment slopes which affects visibility - No road markings - Type of accidents are head-on or drivers go off the road - Sloping from up and meet with those coming up		- Re-establish the road markings - Provide a solid centerline marking to prohibit overtaking - Provide speed restrictions - Redesign the section to provide a climbing lane
19.	Old Picnic – Mabira forest  <i>Heavy pavement distress symptoms (alligator cracking, potholes)</i>		- No road markings - Poorly maintained surface with potholes - Heavy pavement distress symptoms in the form of alligator cracking and potholes - Accidents are due to over speeding and overtaking	- Police Traffic mentioned that whenever the potholes are refilled on this section, it doesn't take 6 months - Head on, run off collisions common as motorists try to evade the potholes	- Re-establish the road markings - Provide a solid centerline marking to prohibit overtaking - Rehabilitation of the pavement to motorable standards - Provide speed restrictions - Routine maintenance i.e pothole patching, clearing of vegetation beside the road etc
20.	Buwola-Mabira Forest 		- A combination of horizontal and vertical alignments - Missing signage - Missing directional arrow (chevron) signs - Faded road marking - Missing climbing lanes signage	This rolling terrain encourages dangerous overtaking which leads to head-on, serious and fatal accidents. It was mentioned that a number of Kenyan pilgrims perished here in a road accident.	- Installation of road signs (directional arrow signs at the horizontal curve, beginning of climbing lane signage) - Application of road marking to mark lane extents and clearly define the climbing lanes using retro-reflective paint - Installation of delineator road studs especially at the curve

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
21.	Sanga-Mabira Forest 		- A sharp combination of vertical and horizontal alignments terminating at a blind spot - Road markings are faded - Roadside bushes have encroached into the roadway - Blind corner - Climbing lane towards Kampala is not clearly visible from the Jinja direction, lacks climbing lanes signage - Most accidents are caused by overtaking and careless driving	- Vertical alignment prompts vehicle to overspeed leading to dangerous overtaking that often end in head-on accidents - Sharp horizontal alignment creates insufficient safe stopping sight distance that causes heads-on accidents in the event of overtaking	- Installation of no overtaking and speed limit signage - Application of road marking to mark lane extents and clearly define the climbing lanes using retro-reflective paint - Installation of beginning and end of climbing lane signage) - Road marking prohibiting overtaking - Clearing of the marauding roadside vegetation
22.	Lugalambo 		- A very straight section with gently sloping approaches - Overgrown sugarcane obstructing the clear zone - No visibility due to overgrowth of cane on road reserve - Climbing lane not clearly marked - Overtaking from both sides Kampala and Jinja leading to head-on collision - Fading road marking	Dangerous overtaking at blind spot often leads to heads-on accidents	- Clearing of the sugarcane within the road reserve - Installation of speed limit and no overtaking warning signage - Revision of road marking to limit overtaking - Construction of climbing lane to widen traffic winding area at the curve

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
23.	Kitigoma Trading Centre  <i>Missing pedestrian crossings. Note the eroded shoulders and lack of bodaboda parking facilities</i>		- A straight highway section running through a busy trading center - Absence of shoulder and parking areas for Public Service Vehicles (PSVs) - Crowding of boda boda facilities at the center - Trucks and cars meet on the crest from both sides	Overspeeding through trading normally leads to pedestrian knockdowns	- Provision of speed calming measures at the centre - Speed limit signage - Application of retro-reflective road marking and delineator road studs - Provision of a designated pedestrian crossing with accompanying signage - Provision of designated bus bays and parking facilities for <i>bodabodas</i> - Separation of highway traffic from town traffic through service lanes in the long term
24.	Bulumaji GM Sugar Factory 		- Road marking is faded; allows for overtaking from both sides but drivers lack adequate sight distances because of the crest - Poor road marking - Missing signage	Dangerous overtaking leads to frequent pedestrian crashes	- Speed limit signage - Application of retro-reflective road marking and delineator road studs - Expansion of road to provide for overtaking and climbing lanes

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
25.	Mbiko Trading Centre 		• Overspeeding vehicles through trading center leads to pedestrian and <i>bodaboda</i> crashes • Absence of road markings and appropriate signage • No designated pedestrian crossings and NMT facilities • Uncontrolled access to the main road	• Overspeeding in a crowded trading center often leads to crashes.	• Speed limit signage • Application of retro-reflective road marking and delineator road studs • Provision of speed calming measures on the approaches to the centre • Provision of pedestrian crossing facilities • In the long term, consider provision of service lanes with controlled access to the main road
26.	Nile Bridge Roundabout-Njeru District  <i>Sharp curve at the Nile Bridge roundabout</i>		• Insufficient traffic winding area at the roundabout • Trucks from Kampala to Jinja overtake • Lack of speed limits • Faded road marking at the roundabout	• Insufficient space often leads to veering off of heavy when they are unable to negotiate the curve	• Review of the roundabout designs • There is a need for reduction of roundabout central island to create more traffic circulatory roadway • Provide for speed limit signs • Application of appropriate road marking at the roundabout to channelize traffic properly

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
27.	Mailii Mbili (Delta Station) 		- Schools in the surroundings - No speed limit signs - The traffic U-turn provision for changing opposing traffic to the other at a straight and traffic-fast moving section of the highway. - There is no transition lanes at the U-turn - Faded road marking - Unsafe road user behaviour by bodabodas	- Absence of transition lane often leads to collision of changing traffic and the main highway traffic - Crossing pedestrians at this straight section with provision of over 100 km traffic get involved in run-overs by speeding motorists	- Elimination of the U-turn so that traffic changes are transferred to a roundabout 500 m away. - Application of retro-reflective road marking and delineator road studs - Enforcement of safe road user behavior by motorcyclists - Installation of speed limits to complement the use of speed guns which are already operational - Provision of a designated pedestrian crossing at a convenient and safe location
28.	Steel Rolling Junction (Jinja Industrial Area)  <i>Insufficient speed change lanes to the factory. Necessary signage also missing</i>		- Heavy goods vehicles turning to the industrial area at a very narrow junction. - No sign posts to indicate trucks turning ahead. - The turning angle is too narrow for heavy vehicle with long radius of curvature - No provision for speed change lanes at the factory - Faded road marking	Absence of transition lane leads to either head-tail accident or overturning of heavy truck during turn negotiation	- Improvement of the access to the factory to allow for sufficient turning radii - Appropriate warning to alert motorists i.e. trucks turning ahead. - Provision of adequate speed change lanes for heavy trucks entering or exiting the factory - Application of retro-reflective road marking to guide motorists

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
29.	Wanyama Road Area  <i>Pedestrian crossing at a non-designated area. Road marking completely faded</i>		- A straight section of the road through sparsely populated shopping area - No pedestrian crossing signs and facilities - No provision for designated bus bays	Overspeeding vehicles often involve in pedestrian crashes	- Provision of pedestrian crossing facilities - Installation of warning signage about crossing pedestrians - Improvement of traffic refuge island to prevent motorcyclists from crossing over - Provision of designated bus bays - Application of retro-reflective road marking to guide motorists
30.	Mungano Wanyange Area  <i>Unsafe road user behavior by motorcyclists</i>		- Straight section of the road with overspeeding traffic - There is no designated pedestrian crossing point - Lack of road markings - Pedestrians are knocked when crossing to join the stage - No gazetted stage or bus stop - Unsafe road user behavior especially by motorcyclists	Absence of pedestrian crossing facilities leads to pedestrians crashes by overspeeding motorists	- Provision of pedestrians crossing facilities - Installation of pedestrian crossing signage - Need for designated bus bays - Application of retro-reflective road marking - Sensitization and enforcement to ensure safe road user behavior by all

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
31.	Wairaka Trading Centre 		• Overspeeding traffic runs through trading center • Absence of pedestrian crossing facilities	• Overspeeding traffic running through trading center leading to pedestrian crashes • Many fatalities are caused by pedestrian knock downs	• Provision of pedestrian crossing facilities adjacent to the provided bus bays • Installation of speed limit signage and road markings • Provision of speed calming measures • Sensitization of the population on dangers of overspeeding traffic through center
32.	Kakira (William) 		• Careless driving and overtaking • Most of accidents are head-on collision • Rolling terrain into a deep valley on a straight section • Distressed carriageway pavement and failing road shoulders eats into the traffic lanes	• Overspeeding vehicles on a rolling terrain get involved heads-on collision leading to fatal and serious accidents • Dangerous overtaking at this section leads to accidents too • Traffic police mentioned over ten (10) accidents at this spot this year	• A climbing lane be provided to accommodate heavy goods vehicles and the slower vehicles. • Appropriate signs should be put in place to caution motorists i.e. speed limit. • Rehabilitation of the whole section • Application of retro-reflective road marking along the stretch • Enforcement of speed limits (speed monitoring cameras would be appropriate in light of the high number of accidents reported)

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
33.	Wandago (Mayuge District) 		- Narrow road in the valley - A straight section of the road with over speeding traffic - Overtaking, hit and fall - Most accidents are head-on collision - Distressed pavement and failing road shoulders - Faded road markings - Unguarded road side ditches at the trough of the vertical curve	Overspeeding vehicles do dangerous overtaking leading to heads-on accidents or self-involving accidents that leads to fall into deep roadside ditches.	- Provision of guardrails on the high embankment at the trough of the vertical curve - Road marking and installation of road signs - Rehabilitation of failing pavement - Installation of hazard marker and height restriction signs at the bridge near the location
34.	Magamaga Police St. Weighbridge  <i>Speed limit sign erroneously reflects as 80kph during the night</i>		- Wrong speed limit signage. It was 80Km before installation of the weighbridge which has been changed into 30Km after weighbridge installation. The same sign post reads 30 during the day and 80 during the night. - Overspeeding vehicles before the weighbridge - Deep roadside ditches - Distressed pavement	Dangerous overtaking by overspeeding vehicles leads to heads-on accidents	- Improvement of signage and road marking - Replacement of the speed limit sign board with a new 30kph speed limit sign - Rehabilitation of the stretch - Installation of safety guardrail on the high embankment sections

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
35.	Waina (Iganga) 		• Straight long road section • Missing speed control markings and signage • Distressed pavement and failing road shoulder reduces traffic lane areas • Most of accidents here are head-on collision	• Overspeeding vehicles on this straight section get involved in heads-on accident due to dangerous overtaking • Four (4) pilgrims reported to have been fatally injured at the location	• Rehabilitation of road pavement • Appropriate road marking and signage • Sensitization and enforcement to ensure safe driving practices
36.	Namasoga  <i>Missing safety fences. Accident involving a medium goods vehicle carrying agricultural produce on the LHS</i>		• A long combination of vertical and horizontal alignment • Insufficient road signage and markings • No/faded road markings affecting visibility. • Vehicles Over speeding. • No sign posts to indicate speed limit.	• Dangerous overtaking leads to heads-on accidents.	• Road markings should be repainted and replaced i.e. the overtaking line mark be replaced with a thick line restricting overtaking. • Appropriate signs should be put in place to warn/alert motorists i.e. speed limit. • Reinstatement of damaged safety fences • Sustained sensitization and enforcement

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
37.	Namasoga-Igenge  <i>Completely faded centre line marking</i>		- Blind corner - A long and sharp combination of horizontal and vertical alignment - A steep crest bound by two deep valleys leading into blind spots at both ends - Most accidents are head-on collision due to careless overtaking	This sharp combination of vertical and horizontal has often caused overspeeding of rolling traffic at the blind spots leading to frequent serious and fatal heads-on collision	- Expansion of the carriageway by construction of overtaking and climbing lanes - Installation of speed limit signage and marking - Installation of a big warning sign of cautioning motorists
38.	Walugogo-Iganga Junction.  <i>Missing speed change lanes at the LHS junction</i>		- A tight junction joining a main Malaba-Kampala highway - Traffic Police mentioned accidents every week at this spot caused by motorists entering Iganga - Access on the LHS lacks speed change lanes - Missing speed calming measures on the approaches to the junction	Joining traffic often collide with speeding motorists on the highway leading to fatal and serious accidents	- Provide retroreflective road marking at the location and delineator road studs at the junction - Improvement of the junction and introduction of speed change lanes - Widening of the carriageway to accommodate storage lanes - Provision of speed calming measures

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
39.	Nakavule-Iganga Hospital  <i>Location has a high number cross road movements by pedestrians but lacks crossing facilities</i>		- Overspeeding motorists through congested settlements and especially involving pedestrians visiting Iganga hospital - Insufficient provision of Public Service Vehicle parking facilities - All types of accidents are observed here: minor, serious and fatal	Overspeeding motorists involve pedestrian crashes, involving fatal and serious accidents	- Provision of pedestrian crossing facilities - Provision of a footbridge as a long term solution - Speed control factors in the form of speed calming measures (speed humps, rumble strips) - Provide retroreflective road marking at the location and delineator road studs - Installation of speed limit signs
40.	Nakalama Junction 		- Traffic conflicting junction to Mbale - A blind spot overtaking as the vehicles enter or leave the junction - Improper overtaking	Occurrence of heads-on accidents due to dangerous overtaking at the blind spot	- Provision of appropriate signage (Junction Ahead, Speed Limit, Advance Directional signs etc) - Enforcement to prevent dangerous overtaking or overspeeding at the junction - Extend the traffic island beyond the horizontal curve towards the Kampala side - Expansion of the junction to accommodate speed change lanes and proper channelization

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
41.	Butende 		• Deep clear zone at the bridge approach • Bridge with deep clear zone • Distressed pavement	• Deep clear zone at the bridge approach normally leads to tip over. • The area is marred by visibility problems in the morning hours due to fog	• Rehabilitation of the pavement • Provision of proper signage • Provision of retro-reflective road marking(consider restricting overtaking) • Provide guardrails on both sides of the road to avoid cars/trucks going off in the swamp
42.	Busesa Valley		• Smooth road with reduced skid resistance • No proper markings • Fog during dry season (3:00 am – 8:00 am) • Distressed pavement; frictionless road surface • A sharp combination of vertical and horizontal alignments leading blind spot • Dangerous overtaking at a blind spot	• Blind spot overtaking often leads heads-on accidents • Road surface becomes foggy and slippery during morning hours • Road without skid resistance surface leads to frequent skidding off	• Rehabilitation of the road to lengthen its design life • Surface dressing the already completed section to increase traction and reduce skid resistance • Proper marking and signage • Emphasis on continuous yellow centerline at blind spots

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
43.	Idudi (near Idudi Muslim Primary School)  <i>Unstandardized speed hump (too large) with no proper warning signs</i>		- Too wide and too high speed hump leading to rear end collisions due to difficulties in climbing over it by vehicles - No warning signage before reaching the traffic hump - Faded road marking	This out of proportion speed hump causes vehicles to make abrupt stops leading to rear end and run off accidents	- Redesign and standardize the hump to allow for safe passage of traffic - Provision of sufficient speed rumble strips on the approaches to the hump - Appropriate warning signage i.e speed hump ahead signs - Application of retro-reflective road marking both on the carriageway and on the speed hump
44.	Rutaba		- Three (3) schools in the surroundings - High population rate - Over speeding traffic through trading centre - Accidents involving children common along the stretch	Over speeding vehicles with no speed control measures often result in pedestrian crashes	- Provision of speed calming measures before reaching the center - Provision of pedestrian crossing facilities - Sensitization of motorists and road user community at the center
45.	Igogero Valley (rice fields) in Bujiri District 		- Straight section with no signage to indicate speed limit and a bridge ahead. - Missing/faded road markings. - Motorists killed due to careless overtaking and over speeding - Truck drivers using free gear - Damaged safety fences	Dangerous overtaking leads to heads-on accidents	- Appropriate signs should be put in place to warn/alert motorists i.e. speed limit and bridge ahead signage. - Application of retro-reflective road marking to replace the already faded paint

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
46.	Busowa-Igogero		- Long straight section with distressed pavement surface - Absence of appropriate road markings and signage - Long straight section encourages complacency in speeding leading to unwarranted accidents and surprises	Distressed pavement surface fail vehicles that try to take emergency breaks leading to single-involving and heads-on accidents	Provision for appropriate speed calming measures
47.	Bugiri Town-Centenary Bank		 - Town located at the end of a descent from the Malaba side - Missing/faded road markings affecting judgment of traffic channeling. - No signage to indicate speed limit and humps ahead. - Dangerous humps ahead. - Careless overtaking /over speeding - Heavily loaded trucks trying to freewheel/ overtake as they approach the town leading to serious accidents in case of loss of control	- Speeding motorists through the center get involved in pedestrian crashes - Police traffic mentioned 5 fatal accidents have been reported in the past year involving trailers in head-on collision	- Provision of appropriate signs (speed limit and speed humps ahead warning signs) - Provision of speed calming measures (rumble strips at regular intervals) on the sloping approach from the Malaba side. - Provision of pedestrian crossing facilities at the town (raised pedestrian crossings/ table tops are more desirable at such a town as they double up as speed calming measures) - Application of retro-reflective road marking to replace the already faded paint - Installation of cameras for speed control especially from the Malaba side approach

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
48.	Naluwerere		• Straight section in a rolling terrain • Faded road markings • No speed limit signage	• Straight rolling section encourages vehicles to make dangerous overtaking often leading to heads-on accidents	• Provision of visible road markings and appropriate signage • Rehabilitation of the pavement to lengthen its design life
49.	Namayemba (59 km to Malaba)		• Wrong marking: Provision of overtaking road markings at the blind spot often leads to dangerous overtaking • Faded markings • Overgrown clear zone	• Dangerous overtaking often leads to heads-on accident	• Provision of appropriate road markings and signage • Roadside clearance to increase sight distances for motorists
50.	Namaserere  <i>The very straight section prompts motorists to overspeed and overtake dangerously</i>		• Straight section without proper road markings • Over speeding • Faded markings • Distressed pavement	• Straight section without proper markings encourages vehicles to make dangerous overtaking which leads to heads-on and self-involving accidents	• Provision of visible road markings and signage

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
51.	Buwuni Trading Centre		- Unmarked road hump - Dangerous over speeding through the center knocking pedestrians	- Unmarked hump forces overspeeding motorists to take abrupt brakes leading to single-involving accidents - Overspeeding motorists crash pedestrians as they speed through the center	- Provision of proper markings and signage - Application of retro-reflective paint on the speed humps - Provision of speed calming measures - Provision of pedestrian crossing facilities - Sensitization of road users including the communities and drivers
52.	Muwayo Trading Centre		- Overspeeding through trading center - Unmarked road hump	- Overspeeding motorists through crowded trading center normally leads to pedestrians crashes - Unmarked road humps causes abrupt braking leading to tipping of trucks	- Provision of appropriate signage and markings - Provision of speed calming measures - Provision of pedestrian crossing facilities
53.	Kibima Rice Scheme		There are many agricultural machines operating in the rice scheme along the main highway	Rice farming machinery interfere with traffic on the main highway and cause accidents	- Provision of different access roads to the rice scheme - Provision of appropriate road markings - Installation of necessary warning signs

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
54.	Namutere Trading Centre 		• Overspeeding traffic through crowded trading center • Sharp corners turning to the center	• Overspeeding vehicles through the center normally get involved in accidents with pedestrians, <i>bodaboda</i> riders and PSVs at the center	• Provision of speed calming measures • Provision of advance warning signs (sharp curve ahead, speed limit, pedestrian crossing signs etc) • Provision of designated <i>bodaboda</i> parking facilities • Provision of appropriate road markings with emphasis on continuous yellow centerlines at the curves • Sensitization of road users including motorists and pedestrians
55.	Busitema Weighbridge  <i>Abnormally long queue at the weighbridge entrance by heavy goods vehicles blocking through traffic</i>		• Crowding weighbridge traffic spills onto the main carriageway • Distressed pavement • Overgrown tree branches and twigs jutting into the carriageway	• Congestion at the weighbridge points causes traffic jam and accidents as through traffic try to overtake	• Provision of ample traffic storage facilities at the weighbridge to address the long queues (consider separate entrance pavements) • Application of retro-reflective road marking to replace the already faded paint • Trimming of the overgrown twigs and branches to increase sight distances for motorists

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
56.	Busitema University Corner		- Sharp corner with overgrown clear zone resulting in a blind spot - Dangerous overtaking by overspeeding motorists	Dangerous overtaking at the sharp corner often leads to single-involving and heads-on accidents from overspeeding motorists	- Provision of appropriate signage and marking against overspeeding and overtaking - Provision of speed calming measures at the section - Roadside clearance to improve sight distances for motorists
57.	Busitema University Valley		Cattle crossing along a straight section of the highway with overspeeding traffic	Overspeeding traffic gets involved in crashes with crossing cows	- Provision of appropriate signs (cattle crossing warning signs) - Sensitization of the communities around this section of the road
58.	Ndaiga Trading Centre		- Reckless driving and overtaking. - Vehicles Over speeding. - Blind curve/corner. - Completely faded road markings affecting visibility.		- Appropriate signs should be put in place to warn/alert motorists i.e. speed limit, speed humps ahead - Application of retro-reflective road marking to replace the already faded paint

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
59.	Ndaiga Bridge  <i>Missing signage on the approaches to Ndaiga Bridge</i>		- Blind corner from the Malaba side that most motorists fail to negotiate - Missing hazard demarcation and bridge ahead advance warning signs - Missing delineator road studs to mark the lane extents at the bridge - Careless driving leading to head-on collisions - Over speeding	Traffic Police reported that 7 people died at this spot last month due to over speeding when the vehicle lost control	- Provision of appropriate signs at and on the approaches to the bridge (hazard marker signs, bridge ahead signs, sharp curve ahead at the Malaba side etc) - Application of retro-reflective road marking to replace the already faded paint - Installation of delineator road studs at the bridge to separate the live carriageway from the pedestrian footpaths - Sensitization of the communities around this section of the road - Enforcement by relevant agencies to prevent dangerous practices by road users
60.	Mile 8 (Magola) 		- Faded rumble strips and humps. - Missing/vandalized speed limit signs - No designated pedestrian crossings. - Pedestrians heedless of traffic - Many motorcyclists most of which ride dangerously - School in the neighborhood		- Provision of a designated pedestrian (preferably an elevated one for clear visibility by on-coming traffic). - Provision of speed limit and advance warning signs i.e speed humps ahead, pedestrian crossing signs etc - Rumble strips should be repaired/replaced. - Sensitization of pedestrians and motorcyclists on safe road user behaviour - Sustained enforcement by relevant agencies

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
61.	Uganda Cement Industry (UCI)/Tororo Cement  <i>Missing speed change lanes at the factory/insufficient turning radius for trucks</i>		• Congestion due to trucks coming in and going out of the factory • Missing/completely faded road markings affecting visibility. • No sign posts to indicate speed limit and trucks turning. • No speed calming measures on the approaches to the factory • Stretch of 500m where occur fatal accidents • Missing speed change lanes and insufficient turning radius for trucks exiting the factory towards Kampala		• Provision of speed change (acceleration and deceleration) lanes into and out of the factory • Reconfiguration of the access to increase the turning radius for Kampala bound trucks • Appropriate signage to warn motorists i.e. speed limit and trucks turning signs. • Speed calming measures be put in place on approaches to the factory i.e. Rumble strips or speed humps. • Consider separation of the directions of traffic at the location using a traffic island to avoid head on collision with on-coming traffic. • Some of the above recommendations could be implemented by the factory as Corporate Social Responsibility (CSR) projects

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
62.	Corner (Tororo/Mbale Junction) 		• Overspeeding and dangerous driving • Traffic confusion due to lack of storage/weaving lanes • Faded road marking at the junction • Motorcyclist crowding • Bodaboda entering the highway without due regard for other traffic • No street lights		• Provision of storage/weaving lanes along the main highway to allow for turning movements • Installation of necessary signage at the junction (Advance Directional signs on main road and Stop/Give Way signs at access roads) • Application of retro-reflective road marking and installation of delineator road studs at the junction • Provision of streetlights to illuminate the important junction
63.	Oriyoi		• Overspeeding on straight section leading to dangerous overtaking • Faded road markings • Missing speed limit signage		• Installation of speed limit signs • Speed calming measures • Application of retro-reflective road marking to guide motorists • Sustained sensitization drives.

5.2. Annex 2: Matrix of Findings and Recommendations on the Rwandan Road Network

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
		National Road 1: Kigali - Butare - Akanyuru Haut			
1.	Urban Exit road 	2.39	The area has a high contingent of motorcyclists and pedestrians walking along the road and making cross road movements. • The carriageway is narrow inhibiting motorability of the road. • Inadequate provision for Non-Motorized Traffic (NMT). • No traffic separation facilities have been provided to segregate the directions of traffic.	Confluence of factors observed can lead to vehicle-motorcycle and vehicle-pedestrian crashes.	• Expansion and channelization of the junction to cater for turning movements. • Provision of adequate NMT facilities i.e pedestrian walkways, cyclist tracks, pedestrian footbridge if justified by pedestrian numbers etc. • Separation of traffic directions to limit interaction between opposing traffic.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
2.	Gihinga   <i>Incorrectly positioned pedestrian crossing (at an access junction)</i>	21.4-22.4	The alignment is characterized by a combination of sharp horizontal and vertical curves winding through a hilly terrain. The following observations were also made: • Incorrectly positioned pedestrian crossing at the middle of an access junction near the 'Kamonyi District headquarters. • Missing pedestrian walkways along the relatively built up area. • The 'Sharp Left Curve Ahead' road sign just before the crash barriers has been partially obstructed by overgrown twigs. • Missing directional arrow signs at the crash barriers to warn motorists of sharp change of direction. • Narrow carriageway with lane widths of 3m and 1.5m wide shoulders. • Missing safety fences along sharp curves on high and steep embankment.	• The narrowed carriageway in a sharply winding terrain might prompt motorists to veer off due to the increased centrifugal forces. • New Jersey crash barriers have however since been installed at some of the most hazardous locations. • Static speed cameras have also been installed to monitor speed limits along the stretch.	• Installation of rumble strips at standard intervals at the beginning of the descent. • Provision of more concrete crash barriers along the alignment to prevent possible run off collisions. • Trimming vegetation around the road signs to increase visibility. • Installation of directional arrow signs and hazard marker signs at the beginning of the crash barriers. • Installation of delineator road studs to mark the lane extents on the carriageway. • Relocation of the pedestrian crossing to a safer location and provision of pedestrian walkways on either side. • In the long term, consider widening the carriageway (at least 3.5m lane width and 1.5m wide shoulders) with adequate NMT facilities and provision of climbing lanes where necessary.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Gacurabwenge   <i>Sharp curves on high and steep embankment with no provision for safety fences</i>	24.4 - 25.4	- The stretch is on a rolling to mountainous terrain and is also characterized by sharp successive curves - Premature termination of crash barriers on the RHS along the sharp curves on high and steep embankment - Missing speed calming measures in the form of rumble strips. - Missing delineator road studs to improve on visibility at night. - Lack of directional arrow signs at the crash barriers and hazard marker signs at the beginning of the barriers.	The sharp curves along the section limit the sight distances for motorists increasing the likelihood of run off collisions.	- Extension of the safety barriers to cover the curves on high and steep embankment. - Installation of rumble strips at standard intervals at the beginning of the descent. - Installation of retro-reflective delineator road studs to mark the lane extents at night. - Installation of the missing directional arrow and hazard marker signs to warn motorists accordingly. - Consider provision of street lighting to illuminate the stretch and hence improve on visibility at night. - Realignment and widening of the road width in the long term.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
4.	Karengera curve  <i>Dislodged crash barrier</i>  <i>Concrete crash barriers on the LHS. Note the tangential skid off marks</i>	36.2	- The section is a long, steep and winding descent necessitating crash barriers on the sharp curves. - Some crash barriers have been knocked off and are dislodged from their natural positions. - Missing directional arrow signs and hazard marker signs at the beginning of the crash barriers. - Overgrown tree branches and twigs jutting into the motorable carriageway - Missing drainage chutes at the foot of the crash barriers to channel surface run off.	- The sharp curves make the descent prone to tangential skids and run-off collisions. - An informative sign cautioning motorists and especially truck drivers to engage low gear is however in place at the beginning of the descent.	- Installation of rumble strips at the beginning of the descent to act as a speed calming measure. - Installation of retro-reflective delineator road studs to mark the lane extents at night. - Installation of the missing directional arrow and hazard marker signs to warn motorists accordingly. - Provision of street lighting to illuminate the stretch and hence improve on visibility at night. - Trimming of the overgrown vegetation.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
5.	Karengera Bridge  <i>Bridge located on a sharp horizontal curve with obstructed visibility</i>  <i>Damaged/inadequate handrails with no sufficient provision for pedestrian walkways</i>	37.1	- The narrow bridge is at the trough of the vertical curve from Musambira. - Obstructed visibility due to the presence of a sharp horizontal curve and overgrown vegetation from the Kigali direction. - Faded directional arrow signs and hazard demarcation signs at the Bridge. - Damaged/visibly weak handrails with no sufficient provision for pedestrian walkways on either side of the bridge. - Poorly terminated/ inadequate flex beam guardrails to sufficiently cover the open windows before and after the Bridge. - Dangerously located access on the RHS just after the Bridge. - Missing delineator road studs to mark the lane extents at the Bridge.	- The location and orientation of the bridge makes it prone to run-off and possibly head on collisions. - In the short term, requisite signage and reflective elements to guide motorists at night should be prioritized on to avert any further crashes.	- Replacement of directional arrow signs to caution motorists on the sharp change of direction. - Installation of hazard marker signs on both sides of the bridge. - Replacement of the existing handrails and provision of pedestrian walkways on either side. - Installation of flex beam guardrails (preferably with retro-reflective studs on the inner side) to cover the open windows on both approaches. - Installation of 'Stop' sign on the RHS access. - Relocation of the access to a safer location should be considered in the long term. - Installation of retro-reflective delineator road studs to mark lane extents. - In the long term, consider widening the carriageway complete with pedestrian walkways and realignment of the section to eliminate the sharp curves.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
6.	Kivumu 	41	Sharp curves on a rolling terrain characterize the section. Other observations include: - Missing directional arrow signs at the curve and hazard marker signs at the beginning of the crash barriers. - Missing delineator road studs to mark the carriageway. - Lack of speed calming measures prompting motorists to speed downhill.	- The location is on a sharp descent with sharp curves making it difficult for descending motorists to control their vehicles. Risk of loss of control therefore exists making it important to lower speed limits. - To improve on visibility at night, streetlights have been provided to illuminate the section.	- Installation of the missing directional arrow and hazard marker signs to warn motorists accordingly. - Installation of speed limits and warning signs cautioning motorists to lower their approach speeds. - Enforcement of speed regulations by relevant authorities. - Installation of retro-reflective delineator road studs to mark lane extents. - In the long term, consider widening the carriageway and provision of climbing lanes in light of the long and steep gradients.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Gahogo  <i>Narrow carriageway with no provision for NMT. Note the obstruction of the shoulders by the street lighting pole</i>  <i>Pedestrians walking on the shoulders due to lack of designated footpaths</i>	51.7 52.7	The built up area has a high pedestrian volume with a narrow carriageway making it susceptible to vehicle-pedestrian collisions. Other observations include: • Narrow carriageway (6m width) and reduced shoulders with no provision for NMT facilities i.e pedestrian footpaths. • Absence of designated pedestrian crossing facilities creating arbitrary crossing points. • Absence of speed calming measures on the approaches to the town. • Obstruction of the shoulders by street lighting poles.	• In addition to the high number of pedestrians, motorcyclists comprise a high population of road users in the town. • Safe road user behavior should therefore be advocated for to reduce or eliminate the vehicle-motorcyclist collisions. • Collisions involving school going children are not uncommon apparently due to speeding traffic with no designated children crossing points.	• Consider provision of pedestrian footpaths with channelized designated crossing points • Provision of raised pedestrian crossings (table tops) at suitable locations and near schools since they double up as speed calming measures. • Sensitization of motorcyclists and pedestrians on safe road user behavior. In the long term, consider the following: • Widening the carriageway and provision of NMT facilities i.e pedestrian footpaths and cycle tracks to limit interaction with motorized traffic. • Construction of a footbridge at the town if justified by the pedestrian numbers.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
8.	Kabgayi District Hospital 	53.5	The Kabgayi District Hospital area is heavily trafficked by pedestrians especially during weekends. Observations made at the location include: - Absence of a raised pedestrian crossing to cater for the high number of pedestrians making cross road movements. - Lack of designated pedestrian walkways along the main highway. - Lack of speed limit signs and speed calming measures on the approaches to the hospital.	- Pedestrians accessing the Kabgayi District Hospital tend to walk on the shoulders to the main highway making them susceptible to vehicle knock downs. - Further, no speed calming measures are in place on the approaches to the hospital access.	- Provision of a raised pedestrian crossing in place of the grade level one. - Provision of pedestrian walkways on either side of the main road. - Installation of rumble strips as a speed calming measure on both approaches to the hospital access. - Provision of speed limits and enforcement of speed regulations by relevant agencies.
9.	Kabgayi Descent  <i>No speed calming measures are in place along the descent</i>		The following observations were made: Dangerous cross junction across the descent just before the right curve. The LHS access is in a depression hence insufficient visibility plays for motorists joining the main highway.	The pedestrian crossing lacks speed calming rumble strips which would otherwise lower the speed for descending motorists.	- Consider staggering the cross junction to a distance of at least 50m between the access legs. - Provision of pedestrian walkways to prevent pedestrians from walking on the road shoulders - Installation of rumble strips both at the beginning of the descent and before the designated crossing to calm approach speeds

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Dangerous cross junction with unsafely staggered legs. Motorists from the LHS have to join the main road from a depression</i>		- Irregular parking by motorcyclists on the shoulders to the main highway further reducing visibility splays at the cross junction. - Narrow carriageway with no provision for NMT facilities. - Lack of speed calming measures prompting motorists to drive downhill at high speeds.	The orientation of the cross junction is dangerous as minimum staggering distance has not been met.	Provision of speed limits and enforcement of speed regulations by relevant agencies
10.	Byimana (Ntenyo)  <i>Pedestrians crossing arbitrarily due to lack of a designated pedestrian crossing</i>	64.5	Safety fences in the form of flex beam guardrails have since been installed reducing the run off collisions. However, the following safety concerns still exist: - No provision for pedestrian walkways and designated crossing points has been made despite the high number of pedestrians at the significantly populated area - Lack of a provision for speed calming measures as you approach the sharp curve	- Two horizontal curves on a rolling terrain converge at the trough of a vertical curve. - Skidding off by speeding motorists at the curve is likely to occur. - Head on collisions as well as vehicle-pedestrian and vehicle-pedal cyclist collisions are also common at the location.	- Provision of speed limits and enforcement of speed regulations by relevant agencies - Installation of rumble strips on either approaches - Provision of pedestrian walkways and a designated pedestrian crossing at a suitable location - Installation of elaborate road signs prohibiting overtaking and overspeeding at the curve and cautioning motorists to exercise caution - In the long term, consider widening the carriageway with sufficient provision for widening at the horizontal curve

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Skid off marks showing difficulties encountered by motorists in negotiating the curve</i>		Lack of enhanced signage prohibiting motorists against overspeeding and overtaking		
11.	Ngoma (‘Umukobwa Mwiza Corner’)  <i>Approach from the Kigali side</i>	122.2	- The location is on an extremely sharp horizontal curve especially for motorists approaching from the Akanyaru direction - The road is narrow with insufficient provision for super elevation to counteract the centrifugal acceleration forces encountered by motorists. - Faded road marking at the location might not be clearly visible at night. - Insufficient speed calming measures on the approaches to the location.	Motorists and especially truckers tend to lose control and run off the carriageway due to increased centrifugal acceleration as they negotiate the tight curve. The area is characterized by multiple skid off marks indicating difficulties encountered by motorists in holding their vehicles within the carriageway.	- Redesigning of the horizontal curve to allow for sufficient super elevation and widening at the curve. - Application of retro-reflective road marking to guide motorists accordingly especially at night. - Installation of delineator road studs to mark the lane extents at night. - Installation of rumble strips as a speed calming measure on both approaches to the curve. - Clearing of the roadside vegetation to improve sight distances

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Multiple skid off marks. Note the lack of super elevation at the tight horizontal curve</i>			- Roll over and head on collisions mostly fatal are common at the spot. 'Danger' signs have been erected along the long descent to warn motorists.	In the long term, consider the following measures; - Widening of the carriageway and realignment of the section to allow for a more gentle curve. - Consider provision of off-road truck run away ramps/arrester beds to cater for heavy vehicles that might lose control.
National Road 2: Kigali - Musanze - Rubavu					
1.	Kigali 		- The beginning of the NR2 from Kigali is characterized by a winding alignment ascending a hilly to mountainous terrain leading to successive combinations of horizontal and vertical curves. General observations include: - Lack of climbing lanes along the long and steep gradients creating significant snarl ups and safety hazards as ascending motorists try to overtake	- Due to the orientation of the road, run off collisions are likely to be catastrophic. - To improve on visibility, streetlights have been installed to illuminate the road at night. - Further interventions are still required to make the section safer.	- The road is 3.5m width, Consider provision of climbing lanes as the ultimate medium to long term solution. - Provision of pedestrian walkways especially in the densely populated areas. - Clearing of vegetation and protruding branches within the road reserve. - Installation of more safety fences to secure the sharp curves on high and steep embankment. - Installation of retro-reflective delineator road studs.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Lack of NMT facilities forcing pedestrians to walk on the carriageway shoulders</i>	0-10	- Narrow carriageway with very sharp curves on steep embankment. - Lack of a provision for NMT facilities causing pedestrians to walk precariously on the narrow shoulders - Obstruction by vegetation and tree branches impairing sight distances. - Missing delineator road studs to delineate the road. - Inadequate warning signs.		Installation of adequate warning signs cautioning road users on all the possible danger spots.
2.	Rusiga	31	- The road edges end dangerously at the edge of the valley increasing the likelihood of roll over collisions into the valley. There is no enough clear zone. - There is insufficient signage.	- The unprotected steep edge can lead to fatal crashes in the occurrence of any error. - Absence of signage can lead to surprises that may cause accidents.	- There is need for provision of reinforced concrete crash barriers along the road edges to prevent possible catastrophic accidents. - Installation of adequate signage to guide motorists.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Nyirangarama  <i>Narrow bridge with insufficient reflective elements and signage</i>  <i>Obstruction of sight distances by roadside establishments</i>	45-47	Nyirangarama Bridge • Conflicting junction at the rolling terrain with a narrow bridge near the junction • The Nyirangarama Bridge is located on a sharp curve with an acute blind spot especially for motorists heading towards Kigali from Musanze • The pedestrian walkways are separated from the carriageway by unmarked raised kerbstone which are a safety hazard by themselves. • The expansion joints of the bridge are exposed compromising its structural integrity. • Missing hazard marker signs at the bridge as well as missing signs warning of a narrow bridge ahead. • Missing safety fences on either side of the bridge handrails leaving dangerous open windows; motorists who lose control might plunge into the river.	• Sharp curve makes it difficult for heavy vehicles to negotiate the turns. Likelihood of veering off the carriageway is increased as a result. • The narrow bridge reduces the available motorable width increasing the chances of motorists colliding with the bridge furniture and also getting involved in head on and side swipe collisions.	• Consider re-construction of a wider bridge with sufficient provision for pedestrian footpaths in the medium to long term. In the short to medium term, consider: • Installation of hazard marker signs on all the four edges of the bridge (to warn motorists from a distance). • Installation of 'Narrow Bridge Ahead' signage from both approaches. • Application of retro-reflective paint on all the four faces to the kerbstone to prevent motorists from hitting them. • Installation of flex beam guardrails (preferably with reflective studs on the inner side) on the approaches to the handrails to seal off the dangerous open windows. • Clearing of the roadside establishments near the bridge to improve sight distances for motorists.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
			- Obstruction of visibility splays by establishments on the LHS; they are too close to the road blocking the sight distances for motorists. Junction with Base – Gicumbi – Rukomo – Nyagatare Road - Lack of speed change lanes at the merger with the NR2 (Deceleration lane from the Kigali side and acceleration lane towards Musanze are missing)		
4.	Rwamenyo  <i>Dangerous sharp curve with little sight distance</i>	45-47	- Very sharp corner with a gentle descent from the Kigali side. - Lack of adequate warning signage cautioning motorists on the sharp curve. - Missing safety fences on the LHS to offer restraint vehicles that might lose control. - Lack of adequate speed calming measures on the approaches to the hazardous spot.	Heavy goods vehicles manoeuvring the curve tend to lose control and topple over into the adjacent ditch.	- Provision of speed limits and enforcement of speed regulations by relevant agencies. - Installation of enhanced signage warning motorists of the dangerous curve. - Installation of flex beam guardrails on the LHS (preferably with reflective studs on the inner side) to offer restraint in the event of an emergency - Consider provision of rumble strips as speed calming measures on the approaches - Repair of the deteriorating shoulder edges to safeguard the pavement's design life

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>Evidence of a recent run-off collision</i>		Damaged road shoulders/deteriorating pavement edges.		In the long term, consider the following: - Widening of the carriageway and re-designing of the section to allow for a more gentle curve with sufficient super elevation - Construction of an off-road truck run-away ramp/arrester bed for emergency use by heavy vehicles that might lose control.
5.	Buranga-Musanze section  <i>Pedestrians walking on the road edges due to lack of NMT facilities</i>	54-64	The densely populated area has a high population of pedestrians mainly accessing the nearby market. Road safety concerns identified include: - Narrow carriageway (3.5m lane width) with no provision of NMT facilities. Pedestrians are forced to walk on or near the road edge as a result. - Open side drains too close to the road edges. - Deteriorating shoulders leaving rugged shoulder edges. - Missing delineator road studs to guide motorists along the centre at night. - Inadequate bus bays forcing vehicles to pick and drop passengers on the road edges.	Pedestrians walking on or near the road edges are exposed to vehicular traffic making them prone to vehicle-pedestrian collisions	- Consider 2m shoulders) and provision of separate NMT facilities along the center i.e. pedestrian walkways, designated pedestrian crossings etc. - Covering the open drains that are too close to the carriageway or reducing the gradient of the their slopes - Repair of the damaged shoulder edges - Installation of delineator road studs to mark the lane extents at night - Provision of standard sized bus bays to allow for safe stops

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
	 <i>shoulders at Buranga centre exposing pedestrians to vehicular traffic</i>  <i>Steep vertical slopes with no provision for climbing lanes.</i>		Buranga – Musanze section (Gakenke District) The section is characterized by long steep, and climbing terrains. Observations made include: • No provision for climbing lanes has been made creating snarl ups and safety hazards as ascending motorists try to overtake. • Inadequate warning signage along the mountainous terrain	Long steep and climbing terrain makes it difficult for ascending motorists and especially heavy goods vehicles. Absence of climbing lane prompts small vehicles to get involved in head-on crashes as they attempt to overtake.	• Robust sensitization and awareness campaigns educating locals on the dangers of hanging onto trucks • Enforcement by relevant agencies to eradicate unsafe/risky road user behavior • Installation of enhanced signage warning motorists to proceed with caution, for instance, 'No overtaking', 'Steep slope ahead' and speed limit signs • In the long term, consider provision of climbing lanes alongside the ascending lanes to make the road safer

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
6.	Bwanju Corner 	99.2	Sharp horizontal curve combined with a gentle vertical curve - Missing warning signs to caution motorists on the sharp curve - Fading road marking (No yellow centreline marking). - Missing delineator road studs to guide motorists at night.	- Most crashes at this location are run-off and are mainly prevalent during the night. - Despite the spot being illuminated by streetlights, more interventions are still required to make the spot safer.	- Installation of directional arrow signs on the outer edge of the curve to warn motorists on sharp change of direction. - Installation of road signage warning motorists of the dangerous curve ahead and prohibiting overtaking at blind corners. - Installation of retro-reflective delineator road studs especially on the outer lane edges. - Application of retro-reflective road marking to replace the fading one (consider using yellow paint for the centerline to harmonize the road network).

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
7.	Mukamira   <i>Missing provision for MMT facilities</i> <i>Un-channelized junction lacking speed change and storage/weaving lanes</i>	110.8	- Heavy presence of pedestrians and school children with no provision for designated pedestrian walkways. - Missing warning signs to caution drivers of the designated pedestrian crossings. - The junction to Muhanga is un-channelized and lacks a provision for speed change (acceleration and deceleration) lanes and storage lanes on the main highway. - Petrol station has no designated entry and exit lanes for use by motorists fueling their vehicles. - Uncontrolled access to the main highway by the multiple roadside shops and establishments.	- Crashes involving pedestrians and motorcycle riders at the junction and along the town are common. - Vehicles entering and exiting the petrol station cause traffic confusion can lead to crashes that involve motor vehicles and motorcyclists.	- Consider provision of designated pedestrian walkways separate from the main carriageway to shield Vulnerable Road Users (VRUs) from motorized traffic. - Installation of both warning and informative signs before and at the designated crossings. - Installation of delineator road studs and especially at the junction to guide motorists at night. - Improvement of the junction through provision of speed change lanes and widening the main carriageway to allow for storage lanes for turning motorists. - Provision of acceleration and deceleration lanes for all petrol/service stations to allow easier transition into and out of the main road. In the long term: - Consider provision of service lanes with controlled entry and exit points to the main highway.

S/N	Name of the Spot	Chain- age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
8.	Nyakiriba Descent/Kanzeze  <i>Overspeeding cyclists</i>  <i>Sharp left curve with no directional arrow signs</i>	122.6 -128.7	Long continuous descent with sharp curves - Missing/damaged signboard cautioning motorists to engage low gears while descending. - Non-reflective stone barriers on the sharp curves. - Fading road marking and missing delineator studs to mark the lane extents. - Overspeeding motorists and pedal cyclists partially due to lack of speed calming measures .	The curvy descent is prone to overspeeding especially by pedal and motorcyclists.	- Installation of enhanced signage warning motorists on the dangerous descent and informatory signage cautioning them to engage low gears. - Installation of directional arrow signs at the stone barriers. - Consider provision of standard reinforced crash barriers (with reflective elements) as safety fences instead of the masonry stone wall barriers. - Installation of delineator road studs to mark the lane extents. - Provision of rumble strips at standard intervals to calm speeds. - Consider instituting speed limits and speed regulation through speed monitoring cameras.
9.	Giza/Rwaza (Rugerero)  <i>Sharp descent with no provision for pedestrian walkways</i>	139.9 - 141.2	- Winding terrain with sharp curves. - Absence of warning road signage. - Lack of a provision for NMT facilities.	Sharp curve on a rolling terrain makes it difficult for heavy trucks on high speed to negotiate the corners.	- Provision of separate NMT facilities to safeguard eg. pedestrian walkways and cycle tracks to safeguard Vulnerable Road Users (VRUs) from vehicular traffic. - Provision of warning signs on all the hazardous elements along the road. - Provision of speed calming measures and speed limits along the descent.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
10.	Rubavu Hospital Junction  	139.9 – 141.2	Approach to the junction is on a descent - Conflicting junction placed at the end of rolling and winding terrain entering Rubavu town. - Missing speed calming measures on the approach to the dangerous intersection. - Fading road marking. - Inadequate signage warning and informing motorists at the hazardous location.	The three way intersection is dangerous and is characterized by multiple conflict zones.	- Consider carrying out a detailed traffic study at the location in light of the unfavourable terrain to inform the most effective solution, for instance, improved roundabout, signalized junction etc. - Provision of speed calming measures on the descent to the junction (consider rumble strips at standard intervals); speed regulation through speed monitoring cameras could also be considered. - Installation of delineator studs to guide motorists at night - Installation of enhanced warning and informative signage, for instance, 'Give Way', and speed limit signs.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
National Road 3: Kigali - Gatuna					
1.	Kigali	0-10	Winding stretch around deep valleys without safety barriers.	Absence of safety barriers can lead to unforgiving crashes if they occur.	Provision of safety barriers to guard against freefall of vehicles into deep valleys should there an accident.
2.	Rusine Bridge	30.4	 The narrow bridge lacks sufficient restraints with the provided tapes and cones being inadequate - The narrowed bridge (6m width) lacks parapets on either side; the LHS guardrails are completely missing - Missing safety fences on the approaches to the bridge leaving gapping open windows - Missing hazard marker signs at the bridge and warning signs to caution motorists on the narrow bridge - The pedestrian footbridge is unfriendly to the elderly and Persons With Disability (PWDs) as it lacks a ramp to join it to the surface level  <i>Abrupt termination of the footbridge making it unfriendly to the elderly and PWDs</i>	- The narrow bridge is a safety hazard as motorists are forced to pass through a constricted roadway. - Head on and side swipe collisions are likely as a result	- As an immediate intervention, there is need for installation of safety guardrails on the bridge - Installation of hazard marker signs on the bridge and warning signs on the narrow bridge from either approaches - Installation of delineator road studs to show the extents of the bridge at night - In the medium to long term, consider: - Expansion/widening the bridge with a sufficient provision for pedestrians on either side - Provision of parapets to the newly constructed bridge to offer restraint in the event of an emergency.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
3.	Musenyi (Idigiri Bridge)   <i>Damaged pedestrian footbridge</i>	30.4	- Two sharp combinations of horizontal and vertical alignments converge into a narrow bridge which has already been structurally compromised by previous crashes - The narrowed bridge (6m width) has damaged guardrails on either side; the LHS guardrail is completely missing - The bridge parapets are too short to offer any significant restraint in case of an emergency - Missing safety fences on the approaches to the bridge leaving gapping open windows - Missing hazard marker signs at the bridge and warning signs to caution motorists on the narrow bridge - Damaged pedestrian footbridge on the RHS; it presents a safety hazard as it might cave in at any time	- The narrow bridge with insufficient safe stopping sight distance at the convergence of two winding terrains creates a hazard to motorists. The problem is further exacerbated by damaged/missing parapets and safety fences. - Collapsed pedestrian bridge is a safety hazard to the pedestrians	- As an immediate intervention, there is need for installation of safety guardrails on the bridge and repair of pedestrian footbridge - Installation of hazard marker signs on the bridge and warning signs on the narrow bridge from either approaches - Installation of delineator road studs to show the extents of the bridge at night In the medium to long term, consider: - Expansion/widening the bridge with a sufficient provision for pedestrians on either side and realignment of the section to eliminate the sharp curves - Provision of parapets to the newly constructed bridge to offer restraint in the event of an emergency.

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
4.	Rwafandi Corner  <i>Very sharp curve with a huge rock outcrop obstructing sight distances</i>  <i>Missing safety fences on the LHS</i>	32.9	- The corner is on a successive combination of sharp horizontal curves and has a huge boulder obstructing sight distance for motorists - Missing safety fences on the LHS - Lack of warning signs on the approaches as well as directional arrow signs to warn motorists on the sharp change of direction - Vehicles negotiating the curve tend to drive on the middle of the road for fear of toppling over due to centrifugal forces	Steep and winding terrains without safety guardrails can lead to unforgiving crashes should they occur.	- Provision of safety fences on the LHS of the curve to restrain errant motorists in case of loss of control - Installation of directional arrow signs to warn motorists on the sharp change of direction - Installation of warning signs on the approaches to the sharp corner - In the long term, consider redesigning of the section to eliminate the sharp curve and further provide sufficient widening at the curves
5.	Ku Inyange  <i>Sharp curve with knocked off safety fences on high embankment</i>		- The hazardous spot is on a descent from Gatuna towards Kigali - Damaged safety fences on the sharp curve leaving a dangerous open window - Lack of directional arrow signs to guide motorists		- Replacement of the knocked off safety fences (consider flex beam guardrails with reflective studs on the inner side) - Installation of directional arrow signs to guide motorists through the sharp curve - Installation of warning signage on the successive sharp curve ahead and informative signage cautioning motorists to drive on low gear

S/N	Name of the Spot	Chain-age (Km)	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement
5.		44.1	• Dangerous termination of the existing guardrail section; The dangerously exposed ends might pierce onto oncoming traffic upon impact • Lack of proper warning signage cautioning motorists on the sharp curve		• Installation of fishtail end pieces on the dangerously exposed guardrail section to buffer motorists upon impact • Installation of delineator retro-reflective studs to mark the lane extents
6.	Mudahakaniwa  <i>1.2m high reinforced concrete crash barrier</i>	44-48	• The road winds through a hilly terrain and is on high embankment for majority of the stretch. • The section is well guarded with 1.2m high reinforced concrete barriers. They are however not painted with reflective paint • Safety fences are however missing on some sections on high embankment • The sharp curves lack directional arrow signs to warn motorists	The high embankment has been secured with concrete crash barriers for most of the stretch	• Consider extending the crash barriers to cover all the curves on high embankment • Installation of reflective tapes on the barriers/ painting them with retro-reflective paint • Installation of directional arrow signs to guide motorists through the sharp curves • Installation of delineator retro-reflective studs to mark the lane extents of way.
7.	Rukomo Roundabout	52.6			

1196 Links Road Nyali, Mombasa, Kenya.



P. O. Box 34068 - 80118
Mombasa, Kenya



Email:
ttca@ttcanc.org



Telefax:
+254 41 4470735



Phone:
+254 41 4470734
+254 729 923574



Web:
www.ttcanc.org



@NorthernCorridor



NorthernCorridor