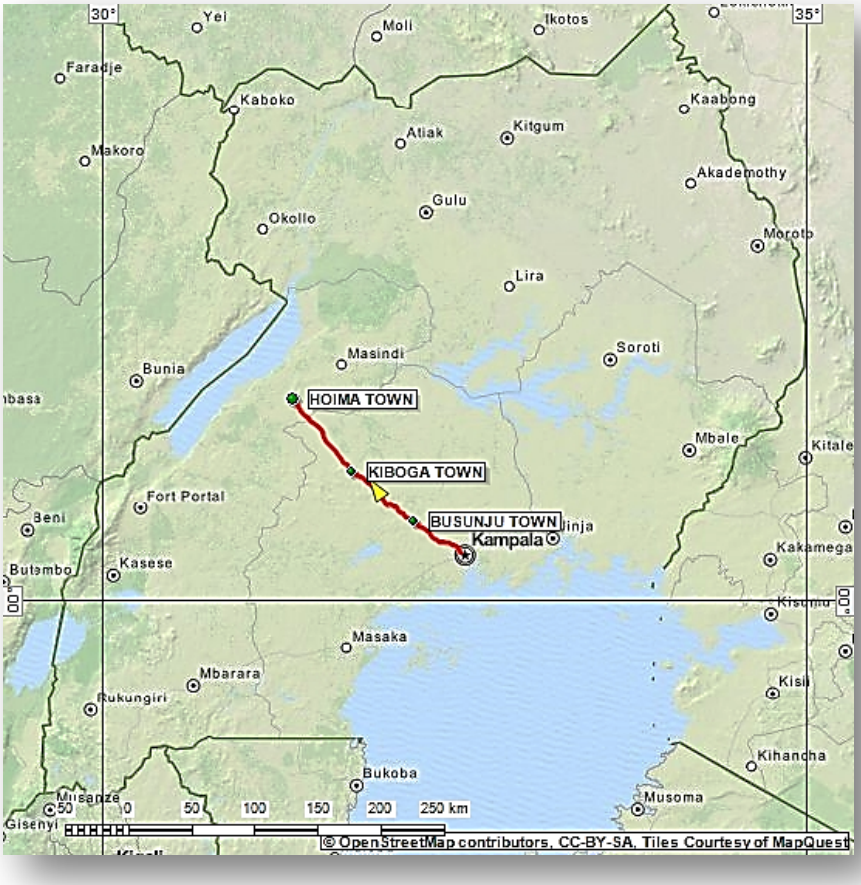
ROAD SAFETY INSPECTION OF KAMPALA-HOIMA ROAD

A Baseline Study



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October 2015

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EXECUTIVE SUMMARY

This report describes the findings of a baseline study to assess safety of Kampala-Hoima Road from the roundabout at Namungoona along Northern By-Pass to Kampala-Hoima-Masindi Y-Junction (190 km). The data used in the assessment included; road traffic accident records, field identification of accident blackspots, road speed profiles, hourly traffic volumes, and road alignment data. The following is a summary of major observations and recommendations:

Observations

Route length and estimated travel duration: Kampala to Hoima at Hoima-Masindi junction is 190 km. It takes on average 160 minutes (2 hours 40 minutes) to cover this distance maintaining an average speed of 80 km/h throughout the route.

Roadside activity hazards by route: Traffic accident data from Uganda Police Force shows that accidents along Kampala-Hoima road occur at trading centers and major towns. The accidents involve collisions between transit vehicles and pedestrians or motorcyclists. Kampala-Hoima road has 35 trading centers most of which have speed humps although not visible especially at night or foggy weather. Therefore, the risk of collision between the subject vehicle and pedestrians or motorcycles is higher along Kampala-Hoima Road.

Identified alignment hazards: Kampala-Hoima road is characterized by a wavy alignment with many steep slopes and sharp horizontal curves (bends). These impact the performance of heavy and long vehicles (trucks and buses). The alignment limits the available sight distance to the driver especially at night. This has an impact on the running speeds and safety of the section between Busunju and Kiboga Towns.

Hourly Traffic Volumes: The traffic volume in the two directions is evenly distributed by volume in one hour. The section between Northern By-Pass and Nansana has hourly traffic volumes in each direction between 350 to 400 vehicles per hour. The section between Nansana and Busunju has more than 200 vehicles per hour in each direction and a comparable volume of motor cycles. Beyond

Busunju, the average hourly traffic volume decreases to below 100 vehicles per hour in each of the two travel directions. In order to reduce travel time and conflicts resulting from roadside activity, Kampala-Busunju section needs to be upgraded to a minimum of four-lane carriageway with a raised median. The median between Kampala and Wakiso should have guardrails to control random pedestrian crossing. This will handle the high traffic volumes, improve travel time, and enhance safety. This is a major capital investment project that should be undertaken by the Government of Uganda through UNRA.

Road Pavement Condition by Route: Kampala-Hoima has poor road surface between Kampala and Busunju, and a good asphalt concrete surface between Busunju and Hoima. It is difficult to attain speeds more than 60 km/h along this road due to a combination of poor road surface, high roadside activity and high traffic volumes. Rehabilitation works to restore good driving surface on Nansana-Busunju Road section commenced in August 2015. It was not possible to establish whether the rehabilitation works also involve expansion of capacity constrained sections of Northern-By Pass to Nansana, and Nansana to Wakiso sections.

Recommendation Interventions

1. Speed enforcement at the following trading centers with high motorcycle and pedestrian fatalities; *Kikubampanga, Namayumba, Wamika, Gobero, Kakiri, Bukomero, Lwamata, Kiboga, Kyakabuga, Kikolimbo, Mukyenda, Katanabirwa, Mutuba, Lwamagaali and Masode*. Speed studies shall be conducted before (one week), during, and after (4 weeks) to assess the impact of speed enforcement campaign at the following selected trading centers due to budget constraints: *Kakiri, Namayumba, Wamika, Bukomero, Lwamata, Kiboga, Kyakabuga, Mukyenda, Katanabirwa, Mutuba, Lwamagaali, and Masode.*

2. Conduct a safe-walk-to-school program (sensitization and marking of school crossing points) for selected thirteen (13) schools along Kampala-Hoima Road. The final list of selected schools includes the following: *Hoima Public School, St. Mary Lwamagaali, Kiyomba Primary School, Kiwawa Primary*

School, Katerabikira Primary school, Bukomero Primary School, St. Kizito Primary School, St. Theresa Nampungu, Mwera Primary School, St. Yowana Primary School, St. Joseph School Nansana.

3. Installation of 36 in number reflective chevron signs at a cost of thirty six million shillings (UGX 36,000,000); and installation of 550 meters of guardrails at selected critical sharp curves to enhance visibility of the road alignment for safe night driving at a total cost of one hundred ninety two million, five hundred thousand shillings (UGX 192,500,000).

4. Painting of road humps and rumble strips with reflective paint too enhance their visibility especially at night. The consultant is however aware that the new Executive Director UNRA has directed responsible Station Engineers to mark and paint these humps, most of the humps have since been painted to enhance safety of motorists.

1.0 INTRODUCTION AND DATA COLLECTION METHODS

1.1 Background

This report describes the findings of road safety inspection of Kampala-Hoima Road. The scope of the study included identification risk factors, collection and analysis of traffic and alignment data, and traffic accident data analysis.

1.2 Study Objective

The objective of the study is to identify and quantify risk factors driving along Kampala-Hoima Road, and propose measures to mitigate some of the identified safety risks.

1.3 Consultant's Team

This study was carried out by a team comprising of three persons: Mr. Paul Kwamusi the Team Leader and Project Manager; Mr. Godfrey Mwesige the traffic and road safety engineer; and Mr. Roy Egesa the safety and data collection assistant.

1.4 Data Collection: Process, Tools and Methods

1.4.1 Risk Analysis Process

Stamatelatos & Dezfuli (2011) defines risk to include the undesirable consequences and the chances or likelihoods that they may occur. That is, '*a product of the likelihood of occurrence of the hazard and the severity resulting from harm caused by the hazard*'. Risk assessment of any system or component amounts to answering three basic questions:

1. *What can go wrong?* Requires Formulating a set of accident scenarios.
2. *How likely is it?* Requires evaluation of the probabilities of these scenarios.
3. *What are the associated consequences?*

The consequence of any interaction between a vehicle and another vehicle, a pedestrian or an animal results in either property damage, minor or serious injuries and in extreme cases fatalities. All the possible consequences are undesirable. Moreover, it is rather impossible to predict with precision if a hazard will result in one or all the consequences. This study concentrated on the identification of possible hazards and likelihoods of occurrence by analyzing traffic, road alignment and road

traffic accident data. Figure 1 gives an outline of the risk analysis process adopted in this study.

1.4.2 Defining Hazards

A hazard or risk factor was defined as anything that may be encountered in the course of driving with a potential to cause harm to the driver and the passengers in the subject vehicle or to other road users in the traffic stream and roadside environment. Hazards arise due to interactions of the subject vehicle with the traffic stream and roadside environment. The following categories of risk factors were identified and investigated:

- Merging/crossing vehicle at access roads onto the study road. This hazard increases the risk of angle collision with consequences of fatalities or serious injuries. This risk is high at trading centers where there are often access roads and localized motor cycle traffic.
- Subject vehicle-pedestrian conflicts. This increases the risk of pedestrian collision with consequences of fatalities and severe injuries as well as possible damage to the vehicle. This risk is high at poorly located trading centers along the roads.
- Subject vehicle-motorcycle conflicts. These increase the risk of fatal and serious injury accidents. Motor cycle traffic operates randomly in the traffic stream with higher risks expected close to trading centers. It is also a dominant mode of transport in upcountry towns.
- High directional hourly volumes increases travel time, driver fatigue and loss of attention.
- Hazardous road alignment characteristics: steep vertical and sharp horizontal curves; limited sight distances increase the risk of collision with opposite traffic vehicles, stationary objects or loss of control in if the subject vehicle is at high speed. This hazard category increases the risk of fatality or serious injury to the driver and passengers.

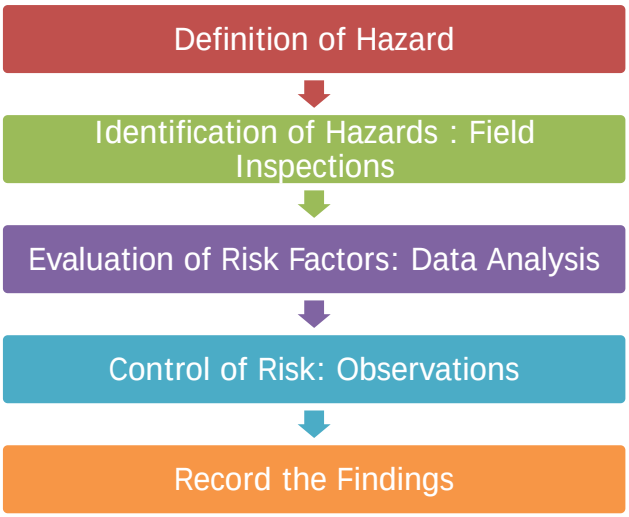


Figure 1: Risk Analysis Process (*Adapted from Newman University College, 2011*)

1.4.3 Data collection Methods and Tools

Field inspections were carried out to collect alignment, traffic, speed profiles and accident data so as to quantify the risk factors along study roads. Tools and methods used to collect respective data are as follows:

- Day time video logging of all the study roads: Using camcorders mounted inside the vehicle. This was important to determine inconsistent alignment features that impact speed characteristics. The video logs were also used to determine locations with high pedestrian and motor cycle traffic concentration.
- Classified traffic counts at selected points for respective study roads on a week day from 7:00 AM to 7:00 PM. This data was important to determine traffic volumes, distribution by direction, and modal split. It was also useful in identifying reason hours of travel between major towns with minimal traffic interference.
- Handheld GPS logging to determine the speed and elevation profile of study roads. This was important to relate the impact of elevation on speeding characteristics and travel time.
- Road traffic accident data was obtained from Uganda Police at respective stations to determine spots where accidents frequently occur along the study roads.

2.0 PRESENTATION OF FINDINGS

2.1 Road Length and Pavement Condition

Kampala-Hoima Road is 190 km between the Northern By-pass in Kampala and Hoima-Masindi Junction near Hoima Town. The road has an average lane width of 3.0 meters and variable shoulder width. The section between Kampala and Busunju is heavily patched and uneven. This reduces riding comfort and the possibility to attain high speeds. Rehabilitation of this section has commenced by the Uganda National Roads Authority (UNRA), and therefore expected to improve in the future. Figure 2 shows typical pavement condition of Kampala-Busunju section.

Figure 2: Typical Pavement Condition of Kampala-Busunju Road Section

The pavement surface of Busunju-Hoima section has asphalt concrete in good condition. The average lane width is 3.0 meters and variable shoulder widths 1.0-1.50 meters. There are several trading centers along this section and rumble strips before and after the trading centre to calm speeds to 50 km/h. The speed limit at non-built-up areas is 80 km/h for both passenger cars and trucks. However, due to a wavy alignment, it is not safe to drive at speeds higher than 80 km/h in the section between Busunju and Kiboga Towns. Figure 3 shows typical pavement condition of Busunju–Hoima Road.

Figure 3: Typical Pavement Condition of Busunju-Hoima Road Section

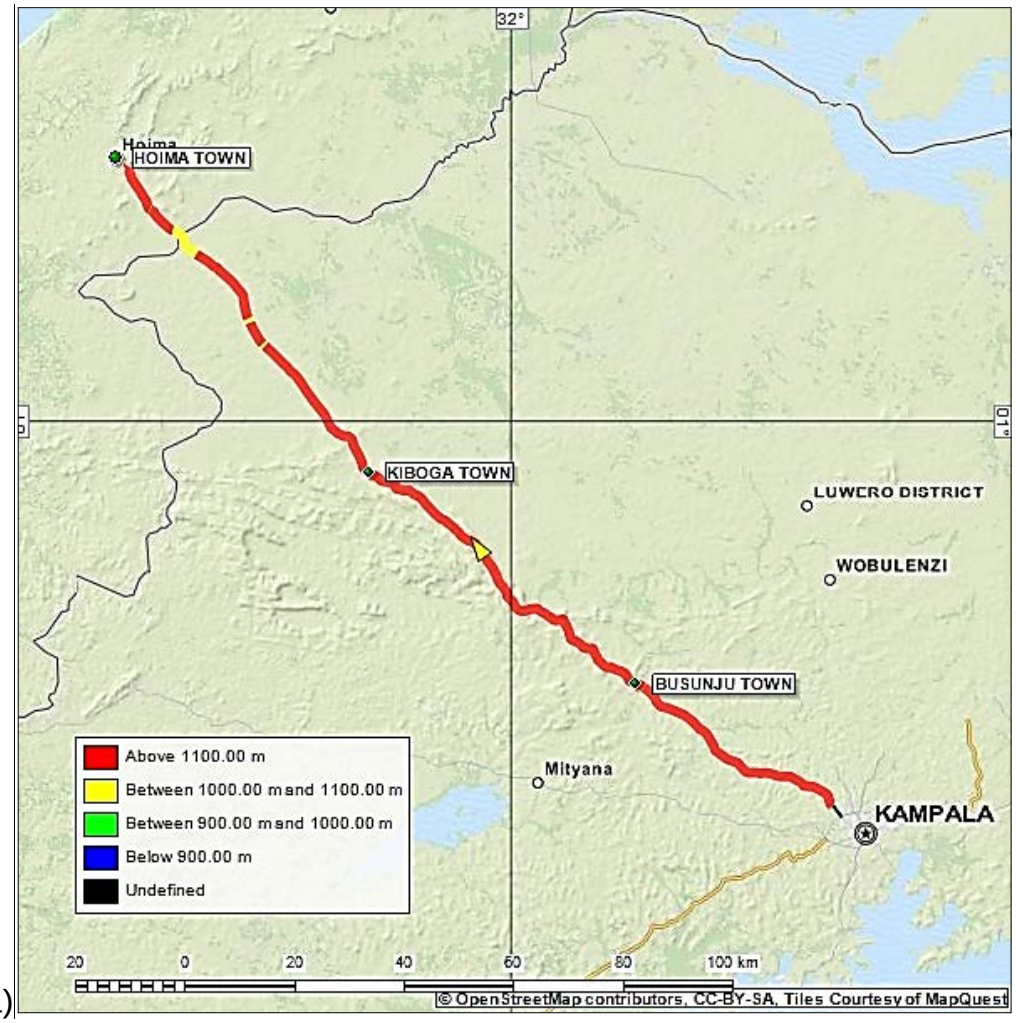
2.2 Elevation Description

Road alignment and specifically elevation impacts speeding characteristics, travel time and increases the risk of certain types of accidents. A rise in vertical alignment over a short distance reduces speeds of trucks and increases the risk of loss of control accidents at horizontal curves for passenger cars. In addition, long queues develop behind the trucks increasing the desire of passenger cars to overtake the trucks. Overtaking is often synonymous with fatal head-on accidents. On the other hand, sharp horizontal curves preceded by long tangents on steep downgrades increases chances of loss-of-control accidents of passenger cars and overturning of trucks.

Alignment data in the study roads was collected using handheld GPS and the data superimposed on MapQuest. Figures 4a and 4b show the elevation plots of Kampala to Hoima in four elevation ranges. Kampala to Hoima, the elevation of the entire road is more than 1100 meters, increasing upwards to a maximum value 1292 meters between Bukomero and Lwamata Trading Centers (See Section 2.6 for town locations). The elevation reduces to between 1000 and 1100 meters above sea level approaching River Kafu, and rises again to above 1100 meters to Hoima Town. The

impact of this rise in elevation is significant changes in travel speeds and duration between origin and destinations.

a)



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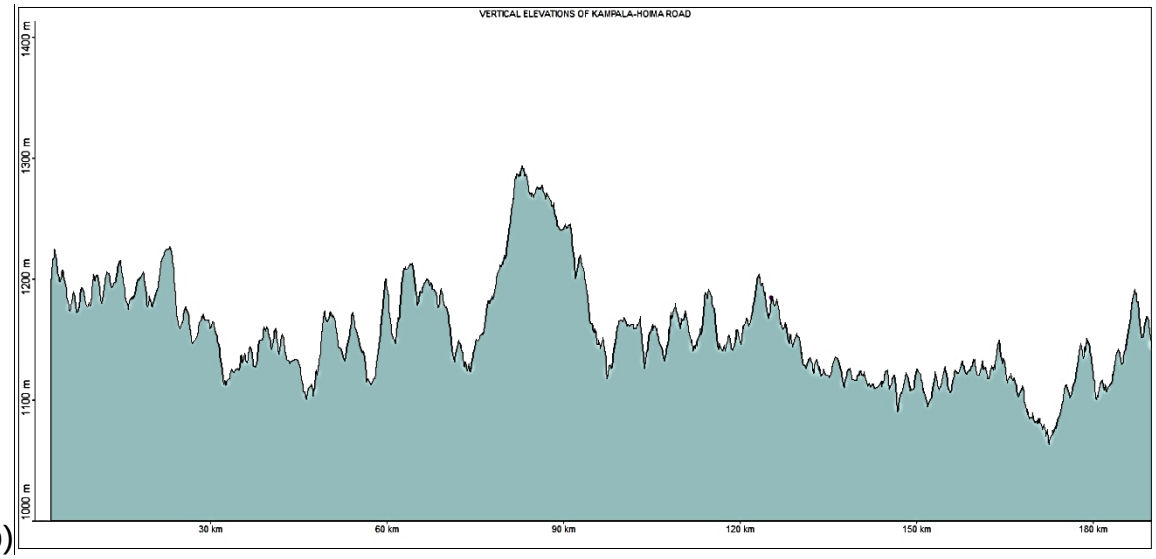


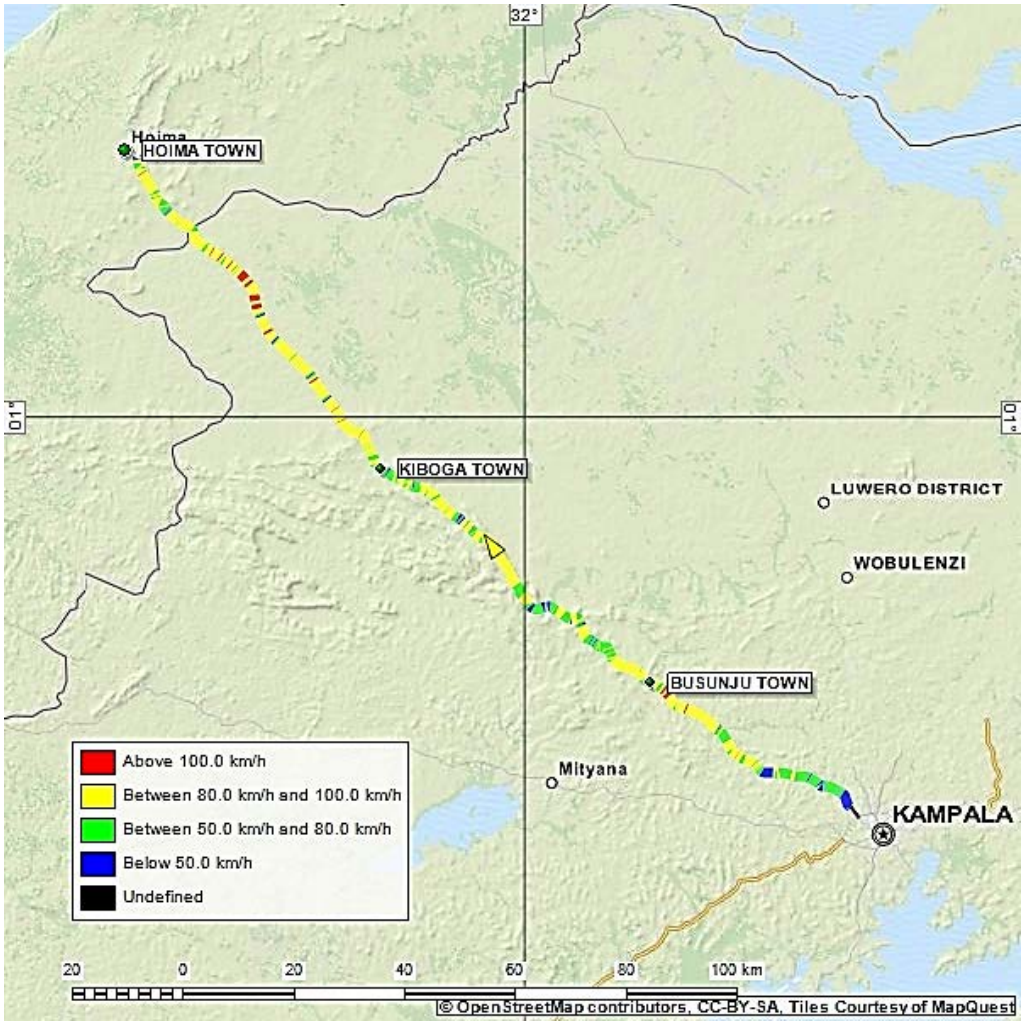
Figure 4: Elevations above sea level of Kampala-Hoima Road (*GPS track overlay on Map Quest***)**

2.3 Road Speed Profile and Travel Duration

Figures 5a and 5b show speed profiles of Kampala to Hoima Road. The average travel speeds along the section is between 80-90 km/h. Safer speeds slightly above 80 km/h are possible after Kiboga Town due to less meandering of the horizontal alignment, reduced roadside activity and decreasing elevation levels (see Figure 5a). Generally, it is risky to travel at speeds more than 80 km/h along the entire road. Figure 5b shows the increased noise in the speed profile. This is due to stop and go phenomenon at trading centers as a result of rumble strips and sharp curves with limited visibility along the alignment between Busunju and Hoima Town. Figure 6 shows typical speed calming using rumble strips at Trading Centers to enforce 50 km/h speed limit. This contributes to routine reduction of speeds to 50 km/h more often along the road.

The estimated average travel duration for a distance of 190 km is 160 minutes (2 hours 40 minutes). Travel speeds between Kampala and Busunju are influenced by traffic volume and roadside activity. Most of the travel time is spent in this section, 50 minutes for a distance of 46 km, which is rather high for the short distance.

a)



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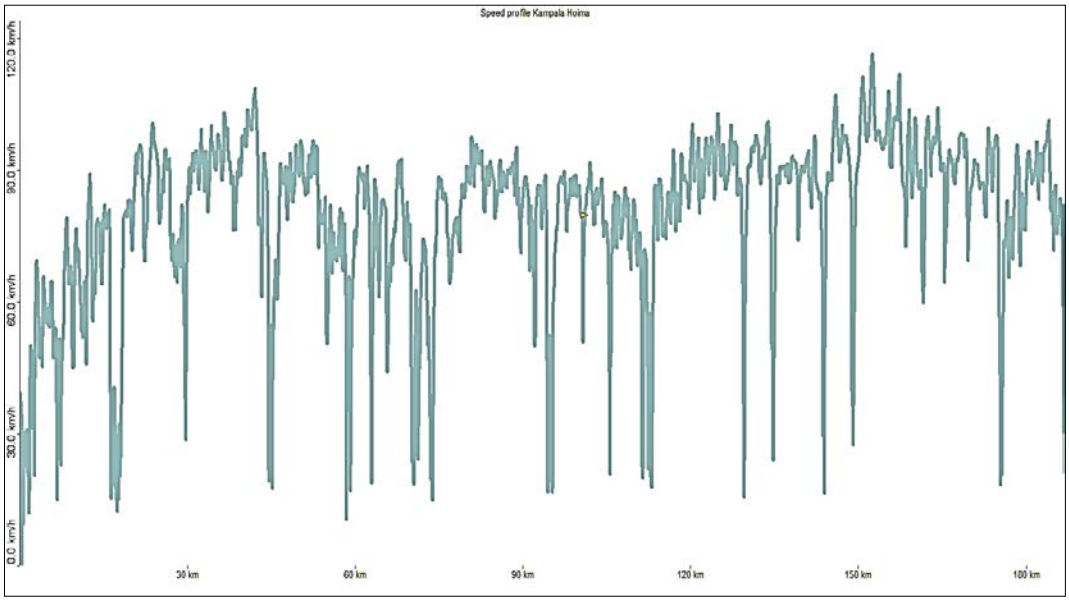


Figure 5: Speeding characteristics along Kampala-Hoima Road (*GPS track overlay on Map Quest***)**

Figure 6: Typical speed calming at several trading centers along Kampala-Hoima Road (*GPS track overlay on Map Quest***)**

2.4 Hourly Directional Traffic Volume

Traffic data was collected from 7:00 AM and 7:00 PM on a week day in two travel directions. The consultant selected four count stations based on observed traffic distribution along the road after a drive through as follows; Rubigi swamp, Kayunga, Wakiso, and one kilometer after Busunju Town. The results show that traffic in two directions is evenly distributed by volume in one hour. The section between Northern By-Pass and Nansana has hourly traffic volumes in each direction between 350 to 400 vehicles per hour. The section between Nansana and Busunju has more than 200 vehicles per hour in each direction and a comparable volume of motor cycles. Beyond Busunju, the average hourly traffic volume decreases to below 100 vehicles per hour in each of the two travel directions as shown in Figure 7.

In order to reduce travel time, and conflicts resulting from roadside activity, Kampala-Busunju section needs to be upgraded to a minimum of four-lane carriageway with a raised median. The median between Kampala and Wakiso should have guardrails to control random pedestrian crossing. This will handle the high traffic volumes, improve travel time, and enhance safety. This can only be handled by the Government of Uganda through UNRA.

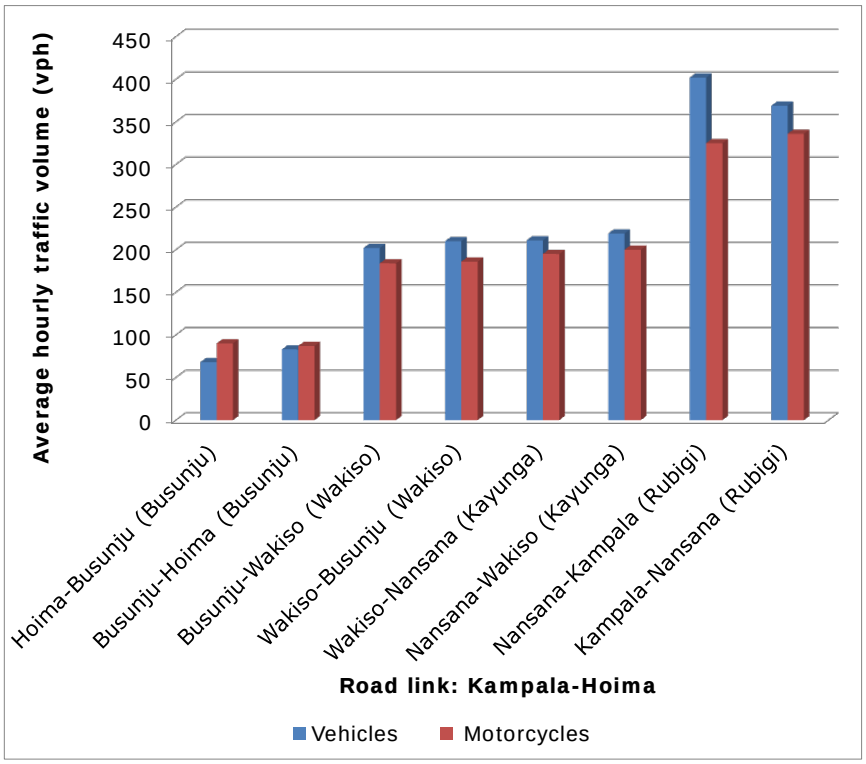


Figure 7: Average hourly directional volumes along Kampala-Hoima Road

A high volume increases travel delay and conflicts between the subject vehicle, motorcycles, and other vehicular and pedestrian traffic. There is a high risk of accidents to motorcyclist and pedestrians on this road especially between the Northern By-Pass and Busunju. Traffic volumes (vehicles and motorcycles) decreases to less than 100 vehicles per hour after Busunju towards Hoima town. The reduction allows freedom of speed choice to drivers, and therefore the section between Busunju and Hoima is prone to over-speeding.

Figure 8 and 9 show hourly traffic volumes for Kampala-Hoima Road. It can be seen that Kampala-Busunju Road section has lower traffic volumes in the period 9:00 AM to 4:00 PM. This is when it is likely that shorter travel duration between Kampala and Hoima can be realized. It is recommended that setting off to Hoima should be delayed up to 9:00 AM and the return journey timed to arrive before 4:00 PM by setting off from Hoima at 1:00 PM.

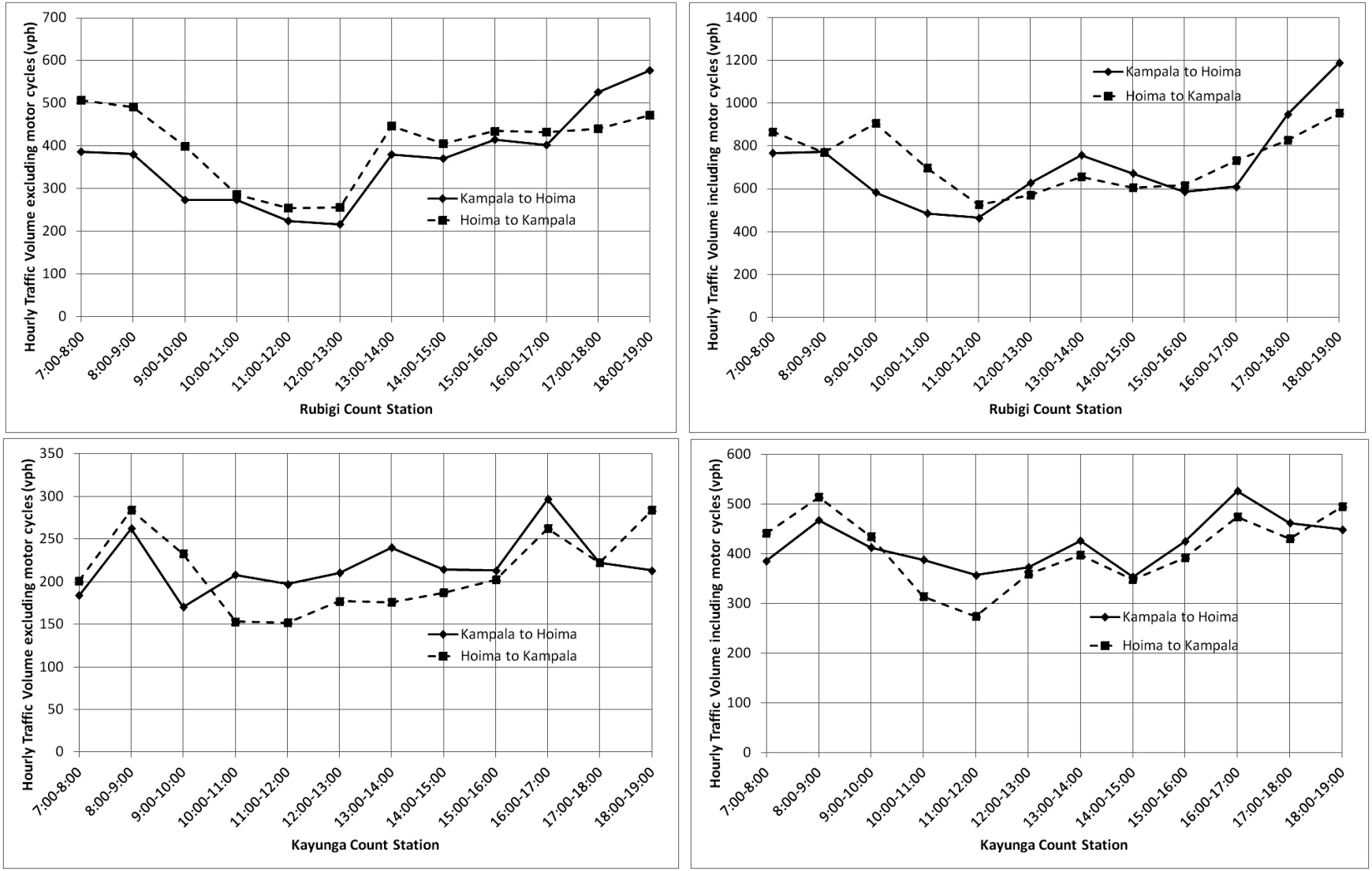


Figure 8: Kampala-Hoima Road Traffic Volumes: Rubigi and Kayunga Count Stations

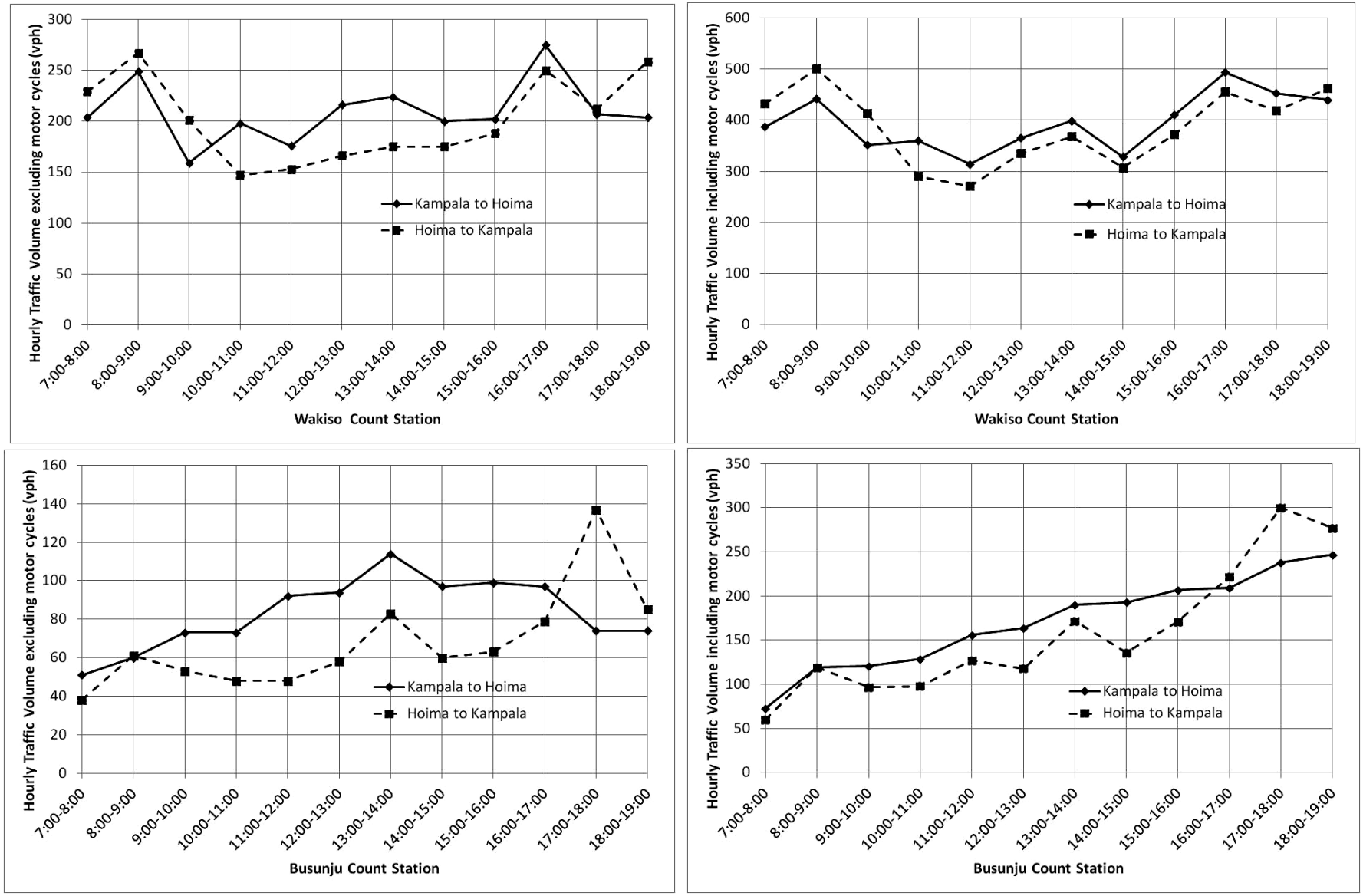
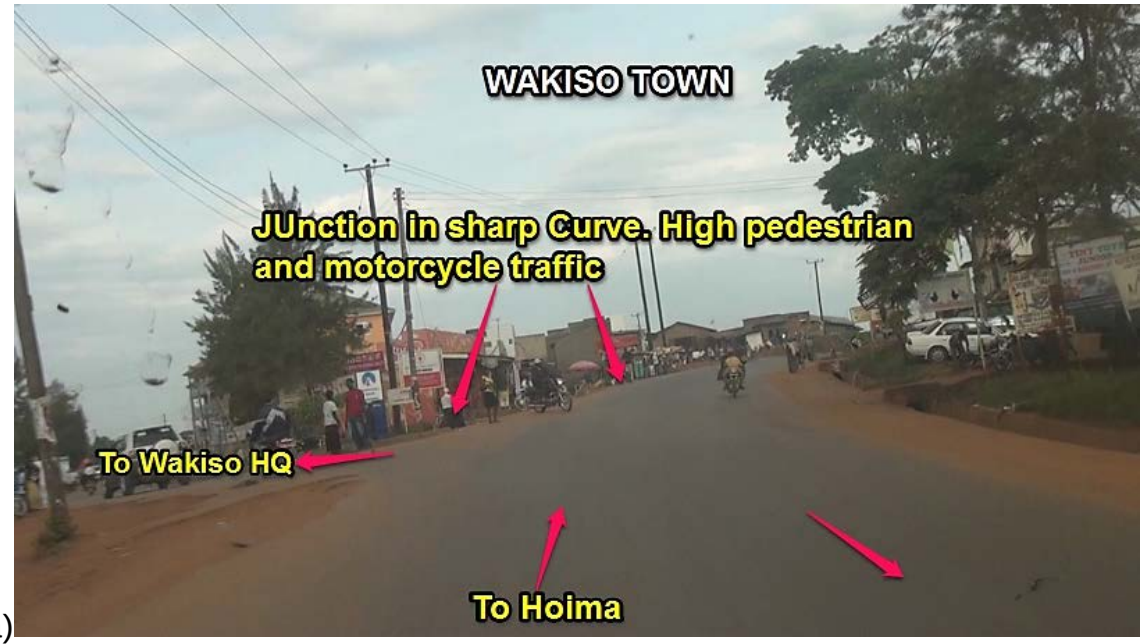


Figure 9: Kampala-Hoima Road Traffic Volumes: Wakiso and Busunju Count Stations

2.5 Traffic Accident Data and Black Spot Location

Traffic accident data obtained from several police stations along Kampala-Hoima Road show predominant vehicle-pedestrian accident spots at towns and trading centers. Most reported accidents for the years 2013 and 2014 involved frequently a vehicle and a pedestrian or a motorcycle. Pedestrian and motorcycle concentration Kampala-Hoima Road is high due to many trading centers (35 in number). Table 1 presents details of traffic accident data obtained from Kakiri, Kiboga and Kyankwanzi Police Posts. Table 2 presents detailed description of the nature of accident risk associated with different spots along the road. In addition risk of collision with motorcycles and pedestrians at trading centers, there are several changing alignment configurations that equally exacerbate accident risk; Kayunga (8 km), Katikamu Light College Junction (33 km), Luweero Junction (67 km), and River Kafu Bridge approach (173 km).

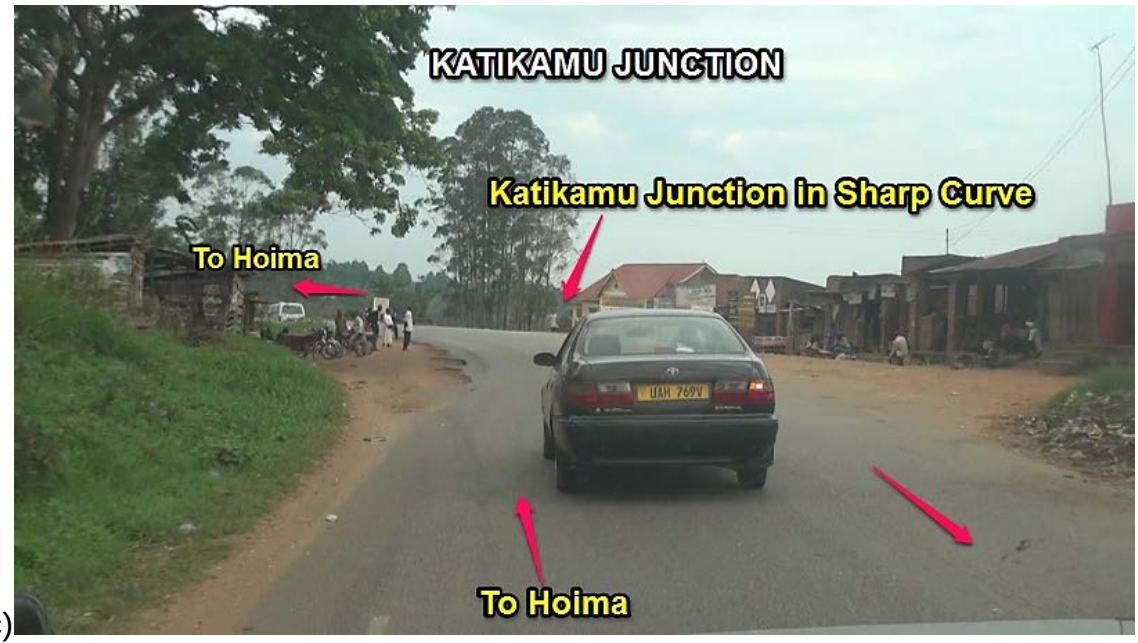
Section 2.6 shows location by distance from the Northern By-Pass of specific black spots along Kampala-Hoima Road. Figure 10 illustrates with photographs of some of the risk spots along the road. These blackspots make Kampala-Hoima road risky for new drivers to the road.

a) 

b)


NANSANA: KAMPALA SURBURB
High Road side activity.
To Hoima

c)


KATIKAMU JUNCTION
Katikamu Junction in Sharp Curve
To Hoima
To Hoima

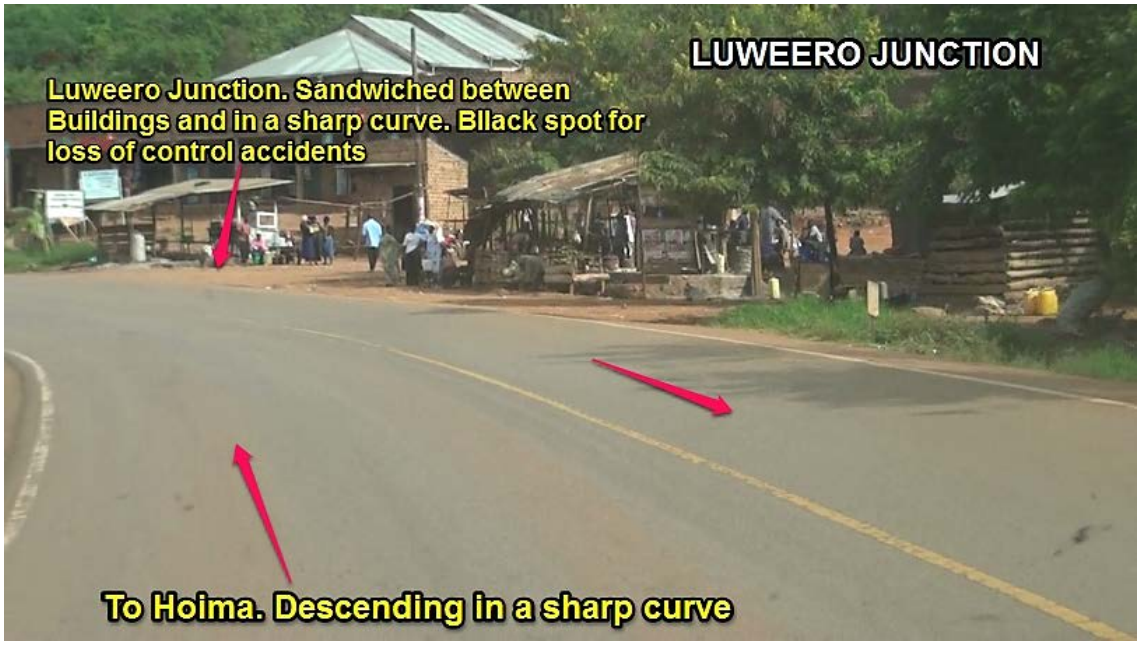
d)


BRIDGE IN CURVE
The bridge is located in a horizontal curve

e)

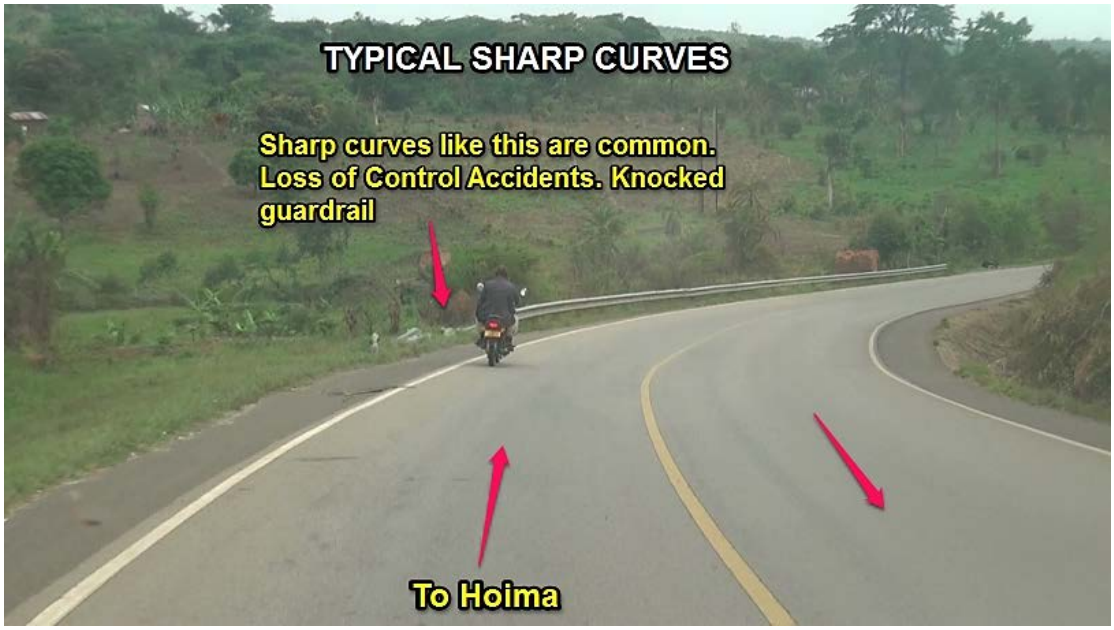

BUSUNJU TOWN
High pedestrian and motorcycle activity

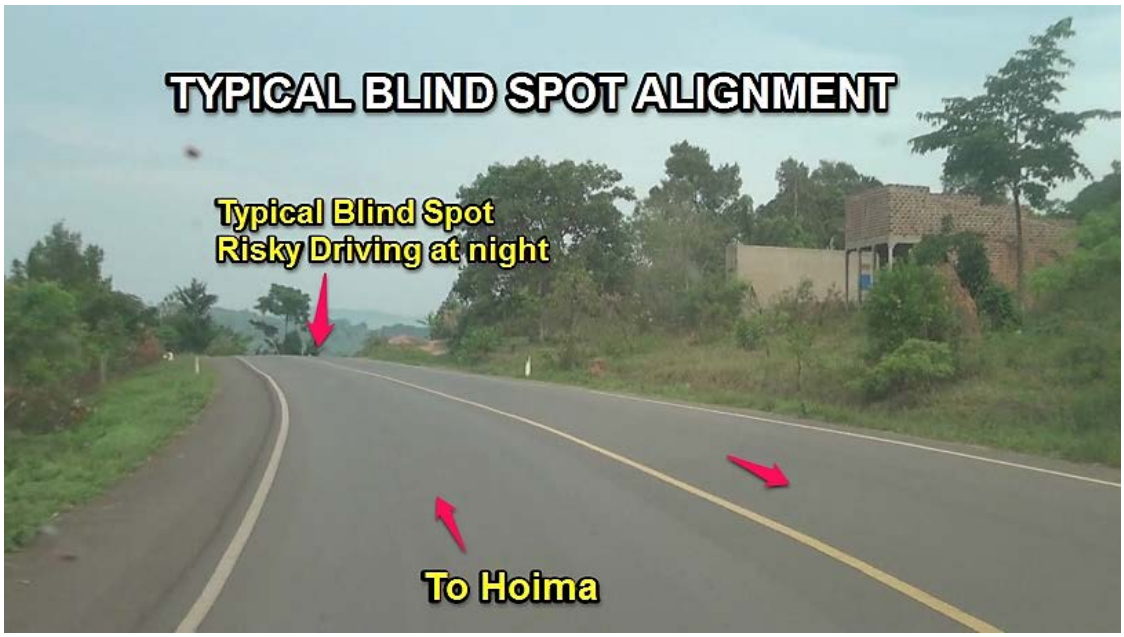
f)


LUWEERO JUNCTION
Luweero Junction. Sandwiched between Buildings and in a sharp curve. Bllack spot for loss of control accidents
To Hoima. Descending in a sharp curve

g)


BUKOMERO TRADING CENTER
High pedestrian and Motorcycle traffic, and increased roadside activity
To Hoima

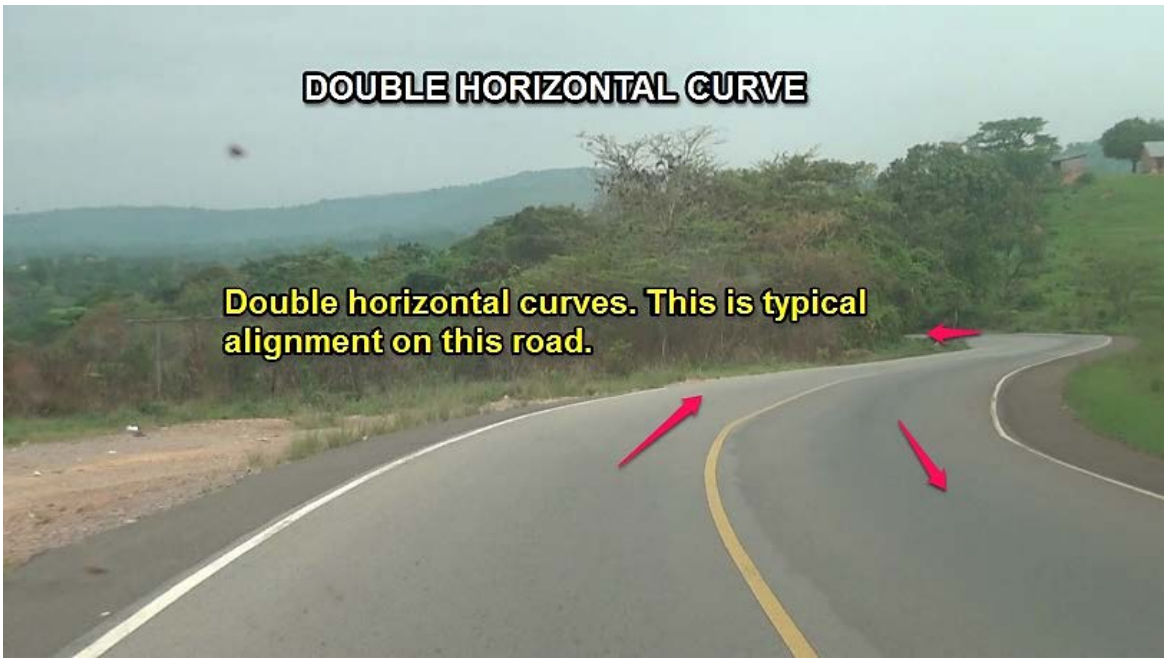
h) 
TYPICAL SHARP CURVES
Sharp curves like this are common.
Loss of Control Accidents. Knocked
guardrail
To Hoima

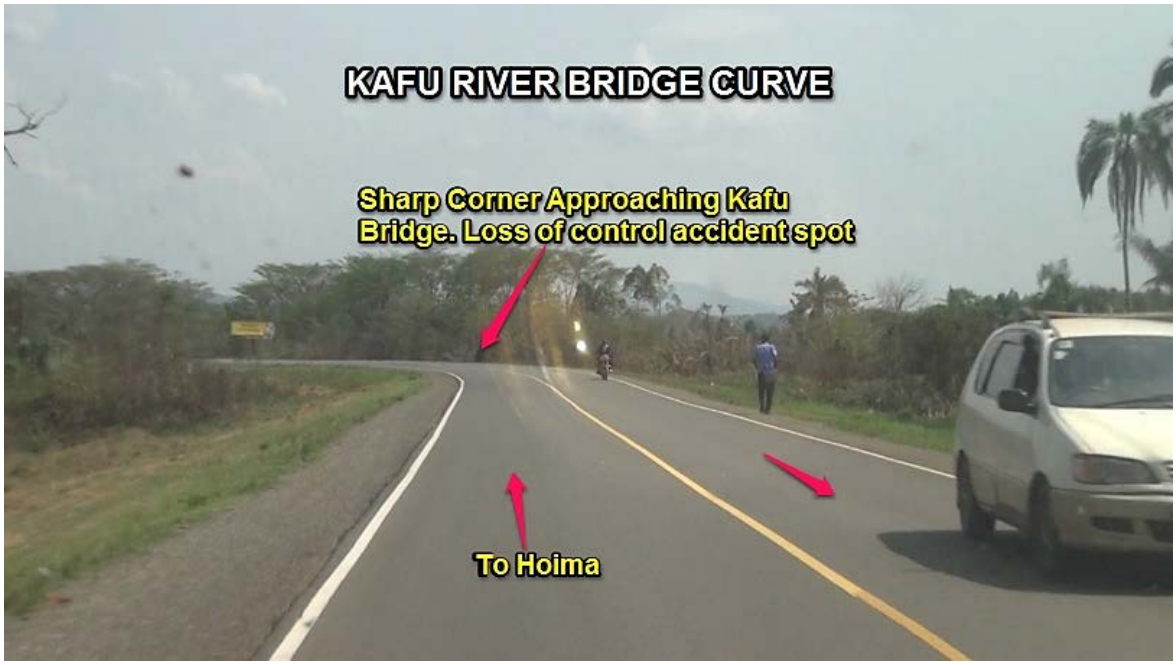
i) 
TYPICAL BLIND SPOT ALIGNMENT
Typical Blind Spot
Risky Driving at night
To Hoima

j)


KIBOGA TOWN
Roadside parking, high pedestrian and motorcycle traffic. Increases risk of collision
To Hoima

k)


DOUBLE HORIZONTAL CURVE
Double horizontal curves. This is typical alignment on this road.

l) 

m) 

Figure 10: Photo plates illustrating risky spots along Kampala-Hoima Road

Table 1: Reported Road Traffic Accidents Summaries

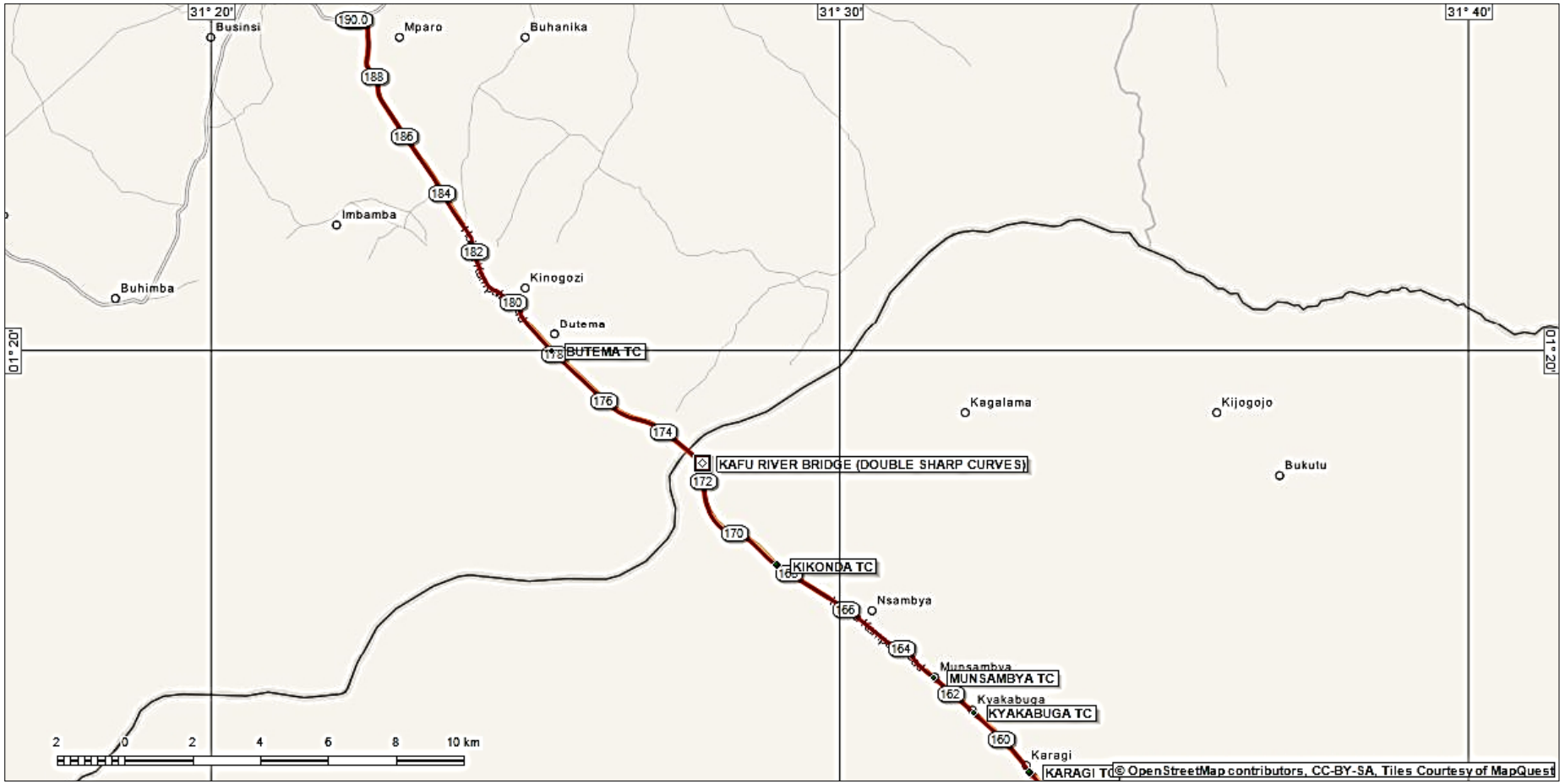
Kampala to Hoima Road: Kakiri Police Post 2013			Kampala to Hoima Road: Kiboga Police Post 2014			Kampala to Hoima Road: Kyankwanzi Police Post 2014		
Place Name	**Severity**	**Reported Cause**	**Place Name**	**Severity**	**Reported Cause**	**Place Name**	**Severity**	**Reported Cause**
Busaku	Serious	Overspeeding	Katuugo	Fatal	Careless driving	Kamirambazi	Fatal	Careless rider
Namayumba	Serious	Overspeeding	Kiboga town	Serious	Incosiderate use of Motor vehicle	Kyakabuga	Fatal	Careless pedestrian
Nkoowe	Serious	Careless Pedestrian	Kiboga opp police	Fatal	Careless pedestrian	Kikolimbo	Fatal	Reckless driving
Kakiri	Serious	Careless driving	Kirinda	Serious	Reckless	Kyakabuga	Fatal	Careless pedestrian
Nampunge	Serious	Overspeeding	Kiboga town	Serious	Careless	Masodde	Serious	Careless driving
Gobero	Serious	Careless driving	Kiwanguzi	Fatal	Careless pedestrian	Muttuba	Fatal	Reckless driving
Nampunge	Fatal	Careless driving	Kituma	Serious	Careless pedestrian	Kyakabuga	Fatal	Careless driving
Wamika TC	Serious	Careless driving	Kyekumbya	Fatal	Careless Cyclist	Lwebisiriza	Fatal	Careless driving
Kasanga	Fatal	Overspeeding	Kyetume	Serious	Careless pedestrian	Masodde	Fatal	Reckless driving
Mwera	Fatal	Reckless driving	Lwamata	Fatal	Careless motorist	Kyenda	Fatal	Careless driving
Nampunge	Fatal	Careless Pedestrian	Kiboga stage	Serious	Careless rider	Kisekende	Serious	Careless rider
Kikubampanga	Serious	Reckless riding	Shell Kiboga	Serious	Careless driving	Kyenda	Serious	Careless rider
Kakiri	Serious	Reckless riding	Lunnya	Fatal	Reckless Driver	Masha's farm	Serious	Careless pedestrian
Wamika TC	Fatal	Careless Pedestrian	Kyekumbya	Fatal	Reckless riding	Kikolimbo	Serious	Careless pedestrian
Kikandwa	Serious	Careless driving	Lwamata	Fatal	Passenger fall off	Musalaba	Fatal	Careless rider
Kikandwa	Serious	Careless riding	Mpangala	Fatal	Careless pedestrian	Kisekende	Fatal	Reckless driving
Kasanga	Fatal	Careless driving	Kasega	Fatal	Careless pedestrian	Katanabirwa	Serious	Reckless driving
Namayumba	Fatal	Careless riding	Katuugo	Fatal	Reckless driving	Muttuba	Fatal	Careless pedestrian
Jjembe	Fatal	Careless driving	Lunnya	Serious	Reckless	Katanabirwa	Fatal	Careless driving
Nkoowe	Serious	Careless Pedestrian	Mogas Kiboga	Fatal	Careless rider	Masodde	Serious	Careless driving
Kasanga	Serious	Careless driving	Buswabulongo	Fatal	Reckless	Kamirambazi	Fatal	Careless pedestrian
Kakiri	Serious	Unknown	Katuugo	Fatal	Careless pedestrian	Karagi	Fatal	Careless pedestrian
Kambe	Fatal	Careless driving	Kalokola	Serious	Reckless riding	Lwebisiriza	Fatal	Careless driving
Busaku	Fatal	Careless Pedestrian	Kirinda	Fatal	Reckless	Kiyombya	Fatal	Careless pedestrian
Kikubampanga	Serious	Careless cyclist	Lunnya	Fatal	Careless pedestrian	Masodde	Serious	Careless rider
Mwera	Fatal	Unknown	Nakayenga	Fatal	Careless driving	Muttuba	Fatal	Incompetent riding
Kikubampanga	Serious	Careless riding	Kagobe	Serious	Reckless driving	Kalagi	Fatal	Hit&Run
Bubwege	Serious	Careless driving	Kituma	Serious	Reckless driving	Lwamagaali	Fatal	Hit&Run
Gobero	Serious	Tyre burst	Lunnya	Fatal	Careless pedestrian	Mbaali	Serious	Over speeding
Kikubampanga	Fatal	Careless driving	Kyekumbya	Fatal	Careless Cyclist	Kamirambazi	Serious	Unknown
Nkoowe	Fatal	Careless Pedestrian	Bukomero	Fatal	Careless pedestrian			
Mwera	Fatal	Careless driving	Mpangala	Fatal	Reckless driving			
Kagala	Fatal	Careless driving						
Nampunge	Fatal	Careless driving						
Kikandwa	Fatal	Careless driving						
Namayumba	Serious	Careless driving						
Kikubampanga	Serious	Careless driving						
Namayumba	Fatal	Unknown						
Nakyerongoosa	Fatal	Careless riding						
Mwera	Fatal	Careless driving						
Muwasa	Fatal	Careless Pedestrian						
Kikubampanga	Fatal	Careless driving						
Namayumba	Serious	Careless driving						
Wamika TC	Fatal	Careless driving						
Kikandwa	Serious	Careless driving						
Nakyerongoosa	Fatal	Hit&Run						
Kikandwa	Serious	Careless driving						
Kikubampanga	Serious	Careless driving						
Kagala	Fatal	Careless driving						
Kikubampanga	Serious	Careless driving						
Kambe	Fatal	Unknown						
Kyanuna	Serious	Unknown						

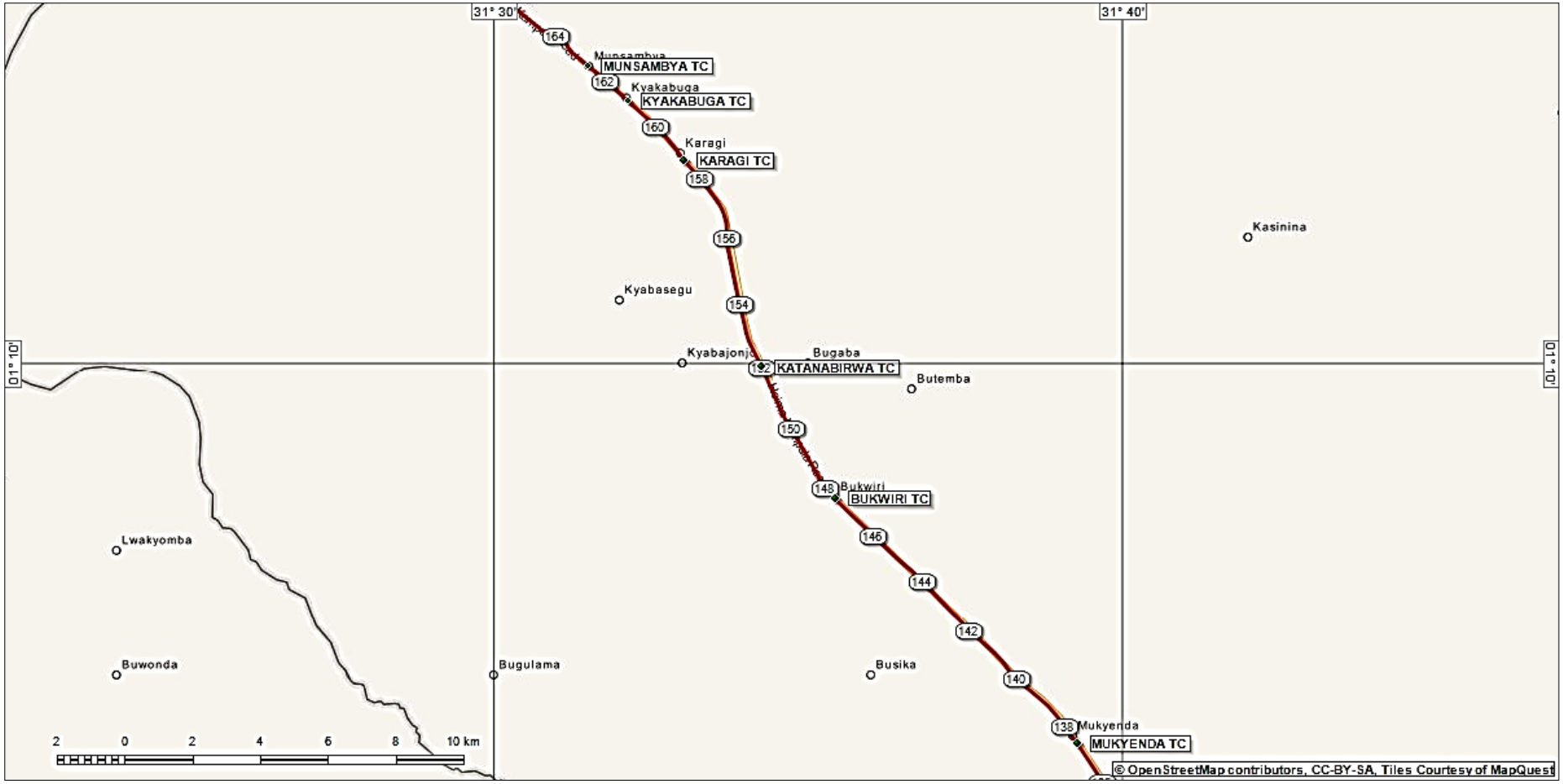
Table 2: Identified Blackspots through Field Inspection along Kampala to Hoima Road

Name of Trading Center	Hazard description	Distance off Northern By-Pass (km)
Northern By-Pass roundabout	High pedestrian and motor cycle traffic on both sides of the road.	0
Nansana		5
Wamala Junction		7
Kayunga	Kayunga Trading Center is located in a double horizontal vertical curve and vertical crest. The trading center is not visible from a distance to the driver in two directions.	8
Wakiso	High pedestrian and motor cycle traffic on both sides of the road.	11
Kavumba Junction		14
Nkowe Junction		17
Kakiri		21
Kakoboza		26
Magongo		30
Nampunge		32
Katikamu Light College Junction	This junction is located in double sharp horizontal curves. The area is high speed with no warning signs. There is a high presence of pedestrians and parked vehicles on the roadside market. It is a known blackspots for loss-of-control accidents.	33
Lukoma	High pedestrian and motor cycle traffic on both sides of the road.	40
Namayumba		42
Busunju		48
Namagavu		56
Matte Roadside Market		59
Kikandwa		62
Junction to Nakaseke and Luweero Districts	Luweero Junction located in a sharp horizontal curve and sag vertical curve. The section is built on both sides of the road. This area is also a known blackspots according to Uganda Police. The approach to this section is a downward slope in two directions. This increases speeding beyond the safe limit to negotiate the curve increasing the risk of loss-of control accidents.	67
Bukomero	High pedestrian and motor cycle traffic on both sides of the road.	74
Kanzira		75
Kateera		78
Buswabulongo		93
Lwamata		99
Kiboga		117
Masode		122
Mutuba		133

Mukyenda		138
Lwamagaali		141
Bukwiri		147
Katanabirwa		153
Karagi		159
Kyakabuga		162
Munsambya		163
Kikonda		169
River Kafu Bridge	Double horizontal curves on a level terrain approaching the bridge. The last curve to the bridge is too sharp requiring the driver to significant reduce approach speeds.	173
Butema	High pedestrian and motor cycle traffic on both sides of the road.	179
Hoima-Masindi Junction	Y-junction for the road to Kampala, Masindi and main Hoima Town. High pedestrian presence and motor cycles.	190

2.6 Location of Major Hazard Spots along Kampala-Hoima Road




31° 30'
31° 40'
01° 10'
01° 10'
164
MUNSAMBYA TC
162
KYAKABUGA TC
160
KARAGI TC
158
156
154
152
KATANABIRWA TC
150
148
BUKWIRI TC
146
144
142
140
138
MUKYENDA TC
Kasinina
Kyabasegu
Kyabajonja
Bugaba
Butemba
Bukwiri
Lwakyomba
Buwonda
Bugulama
Busika
Mukyenda
2 0 2 4 6 8 10 km
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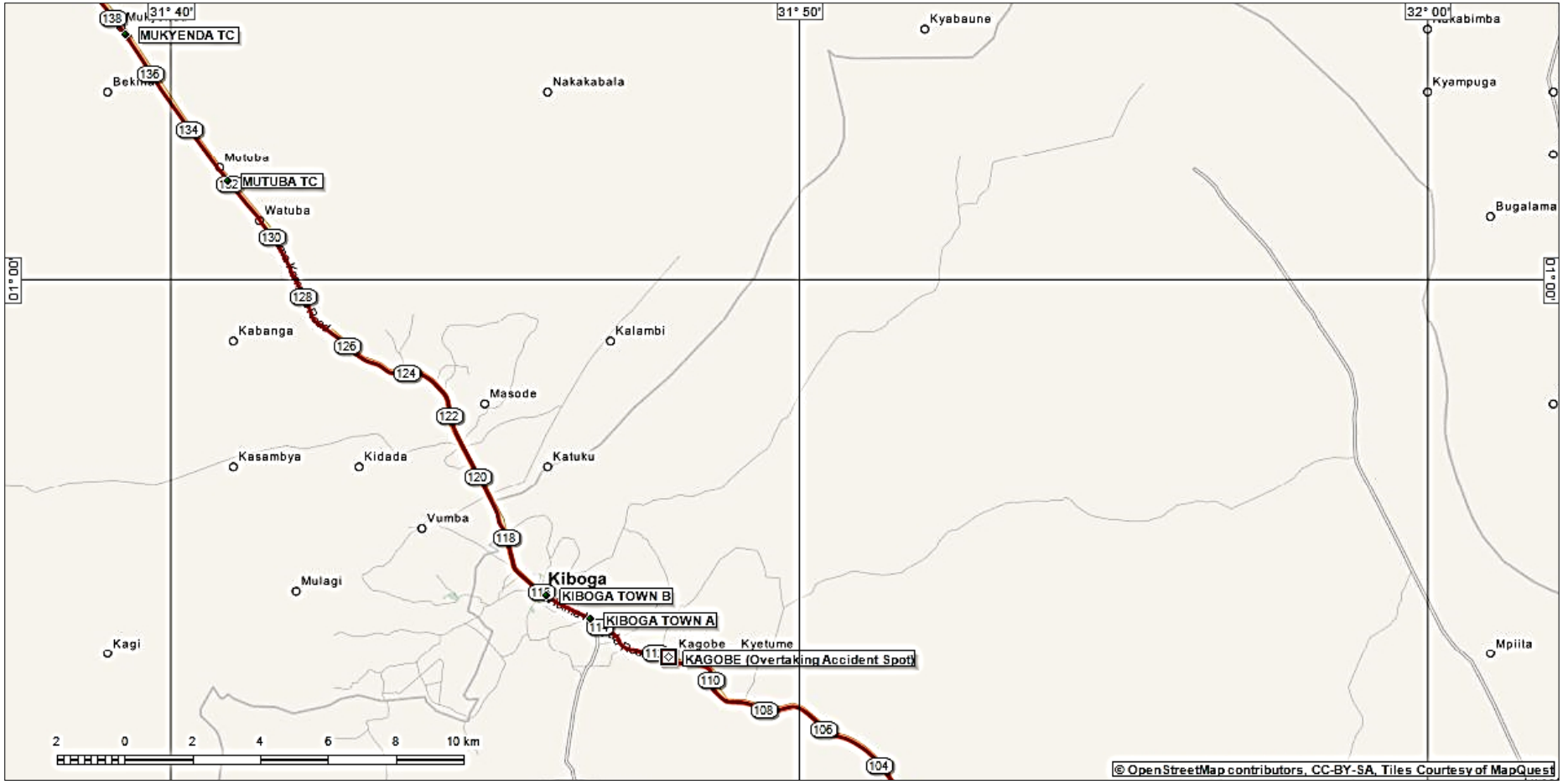
31° 40'
31° 50'
32° 00'
01° 00'
MUKYENDA TC
MUTUBA TC
Watuba
Nakakabala
Kyabaune
Kyampuga
Bugalama
Kabanga
Kalambi
Masode
Kasambya
Kidada
Katuku
Vumba
Mulagi
Kiboga
KIBOGA TOWN B
KIBOGA TOWN A
Kagobe
Kyetume
KAGOBE (Overtaking Accident Spot)
Kagi
Mpiita
138
136
134
132
130
128
126
124
122
120
118
116
114
112
110
108
106
104
2 0 2 4 6 8 10 km
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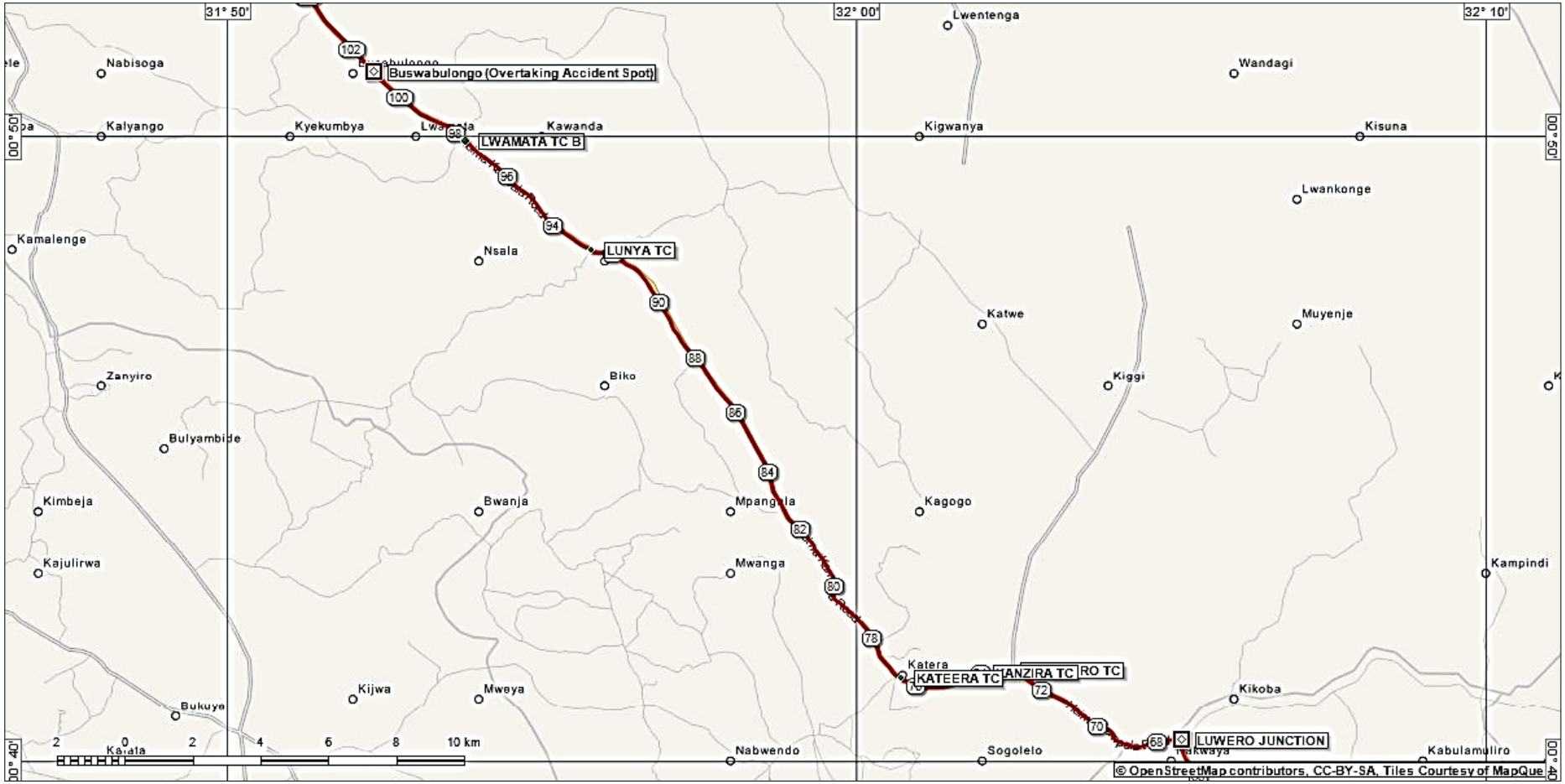
31° 50'
32° 00'
32° 10'
00° 50'
00° 40'
Nabisoga
Kalyango
Kyekumbya
Kawanda
Buswabulongo (Overtaking Accident Spot)
LWAMATA TC B
LUNYA TC
Nsala
Kamalenge
Zanyiro
Biko
Bulyambide
Kimbeja
Bwanja
Kajulirwa
Mwanga
Kijwa
Mweya
Bukuye
Nabwendo
Lwentenga
Wandagi
Kigwanya
Kisuna
Lwankonge
Katwe
Muyenje
Kiggi
Kagogo
Kampindi
Katera
KATEERA TC
Kikoba
LUWERO JUNCTION
Sogolelo
Kabulamuliro
102
100
98
96
94
90
88
86
84
82
80
78
72
70
68
2 0 2 4 6 8 10 km
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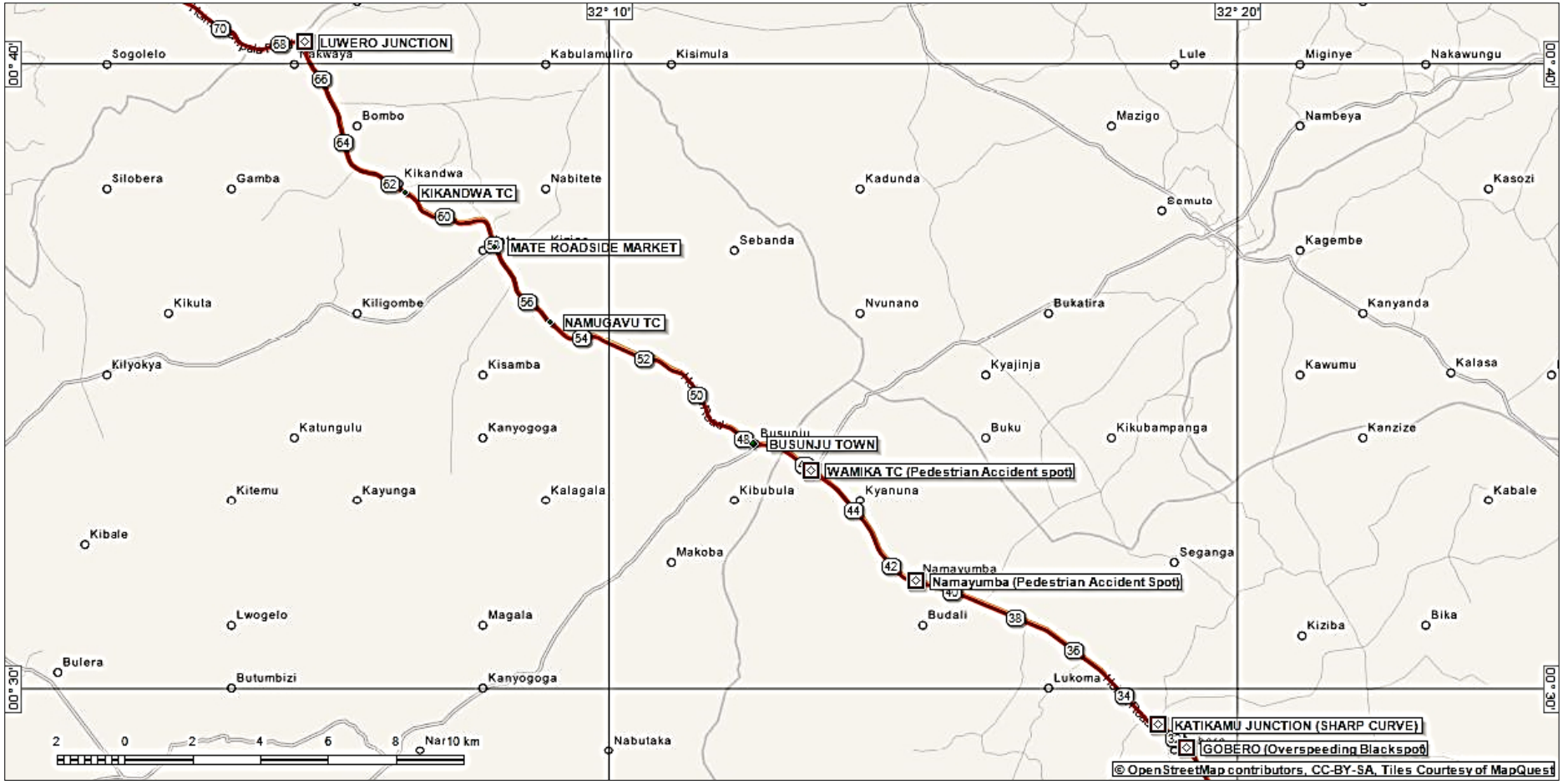
LUWERO JUNCTION
KIKANDWA TC
MATE ROADSIDE MARKET
NAMUGAVU TC
BUSUNJU TOWN
WAMIKA TC (Pedestrian Accident spot)
Namayumba (Pedestrian Accident Spot)
KATIKAMU JUNCTION (SHARP CURVE)
GOBERO (Overspeeding Blackspot)
Sogolelo
Kabulamuliro
Kisimula
Lule
Miginye
Nakawungu
Bombo
Mazigo
Nambeya
Silobera
Gamba
Kikandwa
Nabitete
Kadunda
Kasozi
Semuto
Sebanda
Kagembe
Kikula
Kiligombe
Nvunano
Bukatira
Kanyanda
Kilyokya
Kisamba
Kyajinja
Kawumu
Kalasa
Katungulu
Kanyogoga
Buku
Kikubampanga
Kanzize
Kitemu
Kayunga
Kalagala
Kibubula
Kyanuna
Kabale
Kibale
Makoba
Seganga
Namayumba
Budali
Kiziba
Bika
Lwogelo
Magala
Bulera
Butumbizi
Kanyogoga
Lukoma
Nabutaka
32° 10'
32° 20'
00° 40'
00° 30'
2 0 2 4 6 8 Nar10 km
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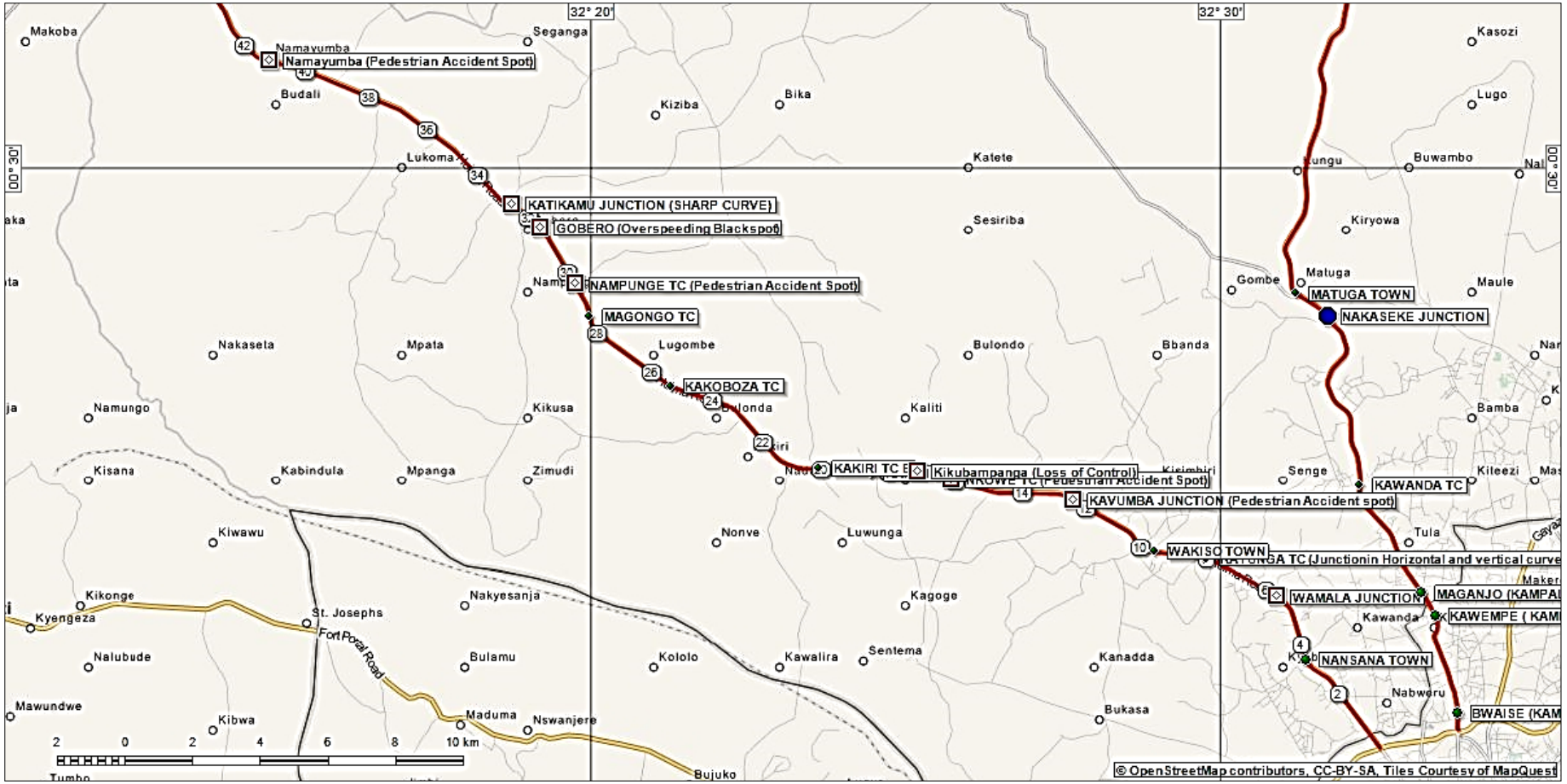
32° 20'
32° 30'
00° 30'
Namayumba (Pedestrian Accident Spot)
KATIKAMU JUNCTION (SHARP CURVE)
GOBERO (Overspeeding Blackspot)
NAMPUNGE TC (Pedestrian Accident Spot)
MAGONGO TC
KAKOBOZA TC
KAKIRI TC
Kikubampanga (Loss of Control)
KAVUMBA JUNCTION (Pedestrian Accident spot)
WAKISO TOWN
WAMALA JUNCTION
NANSANA TOWN
MATUGA TOWN
NAKASEKE JUNCTION
KAWANDA TC
Makoba
Seganga
Budali
Kiziba
Bika
Lukoma
Katete
Sesiriba
Nakaseta
Mpata
Lugombe
Bulondo
Bbanda
Namungo
Kikusa
Kaliti
Kisana
Kabindula
Mpanga
Zimudi
Kiwawu
Nonve
Luwunga
Kikonge
Kyengeza
St. Josephs
Fort Portal Road
Nakyesanja
Kagoge
Nalubude
Bulamu
Kololo
Kawalira
Sentema
Kanadda
Mawundwe
Kibwa
Maduma
Nswanjere
Bukasa
Bujuko
Kasozi
Lugo
Buwambo
Kiryowa
Gombe
Maule
Bamba
Senge
Kiteezi
Tula
Kawanda
Nabweru
2 0 2 4 6 8 10 km
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3.0 RECOMMENDED SAFETY INTERVENTIONS

Based on the findings described in Section 2.0, the following are broad interventions to enhance safety of Kampala-Hoima Road:

3.1 Speed enforcement in Trading Centers

High vehicular-Pedestrian conflicts at major trading centers resulting in fatalities and severe injury accidents. Uganda Police Force needs to be empowered to enforce the 50 km/h speed limit in trading centers. Specifically, speed enforcement is necessary at the following trading centers with high motorcycle and pedestrian fatalities; Kikubampanga, Namayumba, Wamika, Gobero, Namayumba, Kakiri, Bukomero, Lwamata, Kiboga, Kyakabuga, Kikolimbo, Mukyenda, Katanabirwa, Mutuba, Lwamagaali and Masode. These trading centers have high records of vehicle-pedestrian or motorcycle accidents. However, due to budget constraints, it is recommended that Safe Way Right Way carries out 50 km/h speed enforcement at only the following trading centers: *Kakiri, Namayumba, Wamika, Bukomero, Lwamata, Kiboga, Kyakabuga, Mukyenda, Katanabirwa, Mutuba, Lwamagaali, and Masode.*

3.2 Safe Crossing of the Road at schools

Conduct a safe-walk-to-school program (sensitization and marking of school crossing points) for selected primary schools along Kampala-Hoima Road. During the inspection, it was observed pupils walk in groups parallel to the road with several unmarked crossing close to school premises. The following are selected schools by location (distances measured from Northern By-Pass roundabout about.

Distance 2.7km

- St Joseph's Primary Day and Boarding
- St. Joseph Secondary school Day and Boarding

Distance 3.6km

- Nansana Royal Primary school
- London College Day and Boarding

Distance 8.0-8.2km (Kayunga)

- City secondary school
- St Augustine College
- St yowana primary school

Distance 9.7 km (Wakiso)

- St View Junior School

Distance 14.4km (Nkowe)

- Nkowe high school
- St Elizabeth high school

Distance 19.3-19.7km

- Two primary schools
- Henry Memorial Secondary School

Distance 77.6km

- Kateera primary school
- Kateera trust

Distance 112.0km

- Kampala International College
- Muhamudu primary school

Distance 131.1km

- Kiyomba secondary school
- Kiyomba primary school

Distance 138.3 km

- New ABC Junior
- St Mary Lwamagaali

Distance 183.3km

- Kateera Muslim secondary school
- Kateera Muslim primary school

The final list of selected schools in consultation with Safe Way Right Way is as follows: *Hoima Public School, St. Mary Lwamagaali, Kiyomba Primary School, Kiwawa Primary School, Katerabikira Primary school, Bukomero Primary School, St. Kizito Primary School, St. Theresa Nampungu, Mwera Primary School, St. Yowana Primary School, St. Joseph School Nansana*.

3.3 Enhancing Visibility of Horizontal Curves for Safe Night Driving

The horizontal and vertical alignment along Kampala-Hoima road as described in Section 2.0 presents sudden unexpected driving environment to the driver. It is common to arrive at a curve without knowing whether the road turns left or right. This increases the risk of roll-off accidents especially at night and during day for drivers not familiar with the Road.

We propose that chevron reflective signs be installed at the following critical sharp curves to enhance visibility of the road alignment and enhance night driving safety (see Table 3). Note that Kampala-Busunju section is omitted since it is currently under re-development. It was not possible to access the design drawing to assess safety measures put in place for some of the unexpected alignment features. It is estimated that the total cost of installing reflective chevron signs at identified bends will be thirty six million Uganda shillings (UGX 36,000,000).

It was also determined that some sections along the road require extension or installation of new guard rails to protect both motorists in cases of loss-of-control while negotiating curves, and a need to protect houses located on the lower side of the curve. The location, quantities, and the estimated costs are presented in Table 4. The unit cost includes works to procure material, and installation at indicated spacing and quality of concrete. The total estimated cost for the guardrail extension and installation is one hundred ninety two million, five hundred thousand shillings (UGX 192,500,000). The guardrail installation details are presented in Section 3.6.

Table 3: Proposed locations for installation of reflective chevron signs

Location (KM Post)	Side of the Road (RHS or LHS)	Number of signs required	Unit Rate (UGX)	Amount (UGX)
KIB 65	LHS	1	1,000,000	1,000,000
KIB 64	LHS	1	1,000,000	1,000,000
KIB 63	LHS& RHS	2	1,000,000	2,000,000
KIB 61	LHS	1	1,000,000	1,000,000
KIB 60	LHS	1	1,000,000	1,000,000
KIB 59	LHS	1	1,000,000	1,000,000
KIB 56.5	LHS	1	1,000,000	1,000,000
KIB 55.5	LHS	1	1,000,000	1,000,000
KIB 54	LHS	2	1,000,000	2,000,000
KIB 52	LHS	2	1,000,000	2,000,000
KIB 50.5	LHS & RHS	2	1,000,000	2,000,000
KIB 48 (Luweero Junction)	LHS & RHS	2	1,000,000	2,000,000
KIB 46	LHS & RHS	2	1,000,000	2,000,000
KIB 39.5	LHS	1	1,000,000	1,000,000
KIB 36	LHS & RHS	4	1,000,000	4,000,000
KIB 35	LHS	1	1,000,000	1,000,000
KIB 34	LHS & RHS	2	1,000,000	2,000,000
KIB 32.5	LHS	1	1,000,000	1,000,000
KIB 31.5	LHS	1	1,000,000	1,000,000
KIB 26	LHS& RHS	2	2,000,000	2,000,000
KIB 24	LHS	1	1,000,000	1,000,000
KIB 21	LHS	1	1,000,000	1,000,000
Kafu River Bridge	RHS	1	1,000,000	1,000,000
Kiribanywa River Bridge approaches (16km from Hoima-Masindi Junction)	LHS and RHS	2	1,000,000	2,000,000
Grand Total				**36,000,000=**

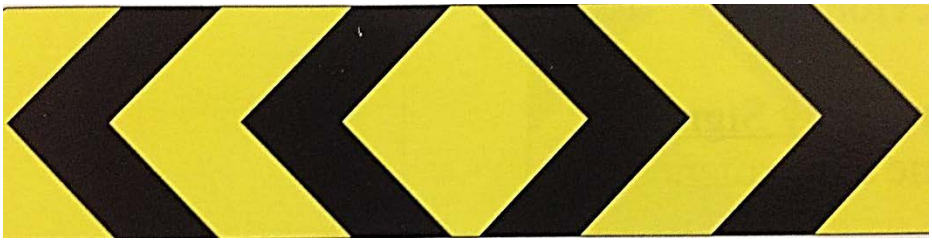
Table 4: Proposed locations for installation of guardrails

Location (KM Post)	Side of the road (LHS, RHS)	Length (meters)	Unit Rate (UGX per meter)	Amount (UGX)
KIB 59 (extension of guard rail)	LHS	100	350,000	35,000,000
KIB 55.5 (extension of guard rail)	LHS	90	350,000	31,500,000
KIB 54 (new guardrail)	LHS	110	350,000	38,500,000
KIB 52 (new guardrail)	LHS	120	350,000	42,000,000
KIB 46 (new guardrail to protect homes on the lower side)	LHS	80	350,000	28,000,000
KIB 36 (extend guard rail)	LHS	50	350,000	17,500,000
Grand Total				**192,500,000=**

3.4 Enhancing Visibility of Road humps and rumble strips

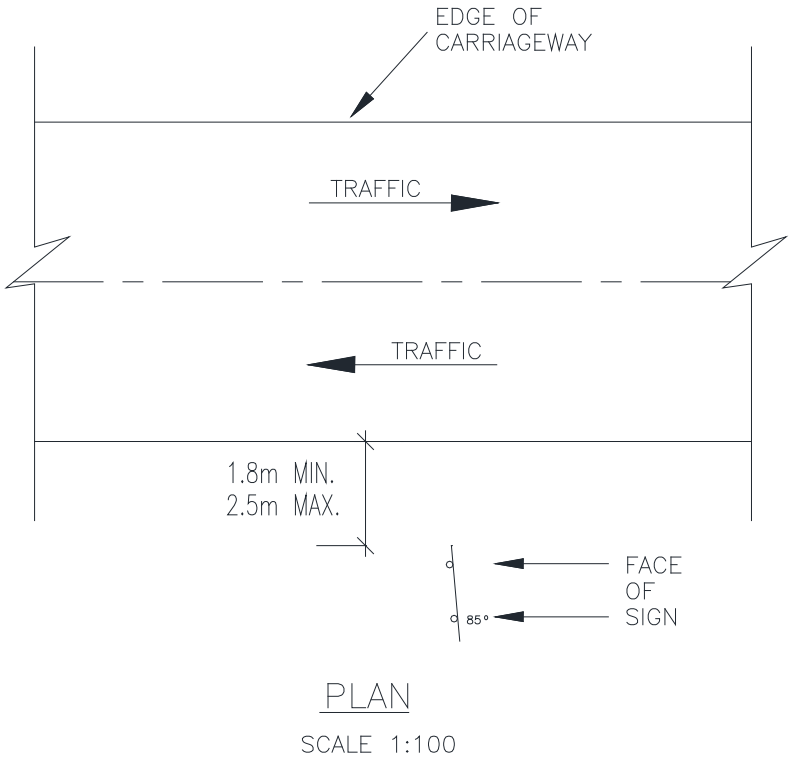
Several road humps and rumble strips installed along this road at trading centers are neither marked nor visible to the driver. These need to be painted with reflective paint for safety of motorists. The consultant is however aware that the new Executive Director UNRA has directed responsible station Engineers to mark and paint these humps. Almost all humps and rumble strips have been painted along this road.

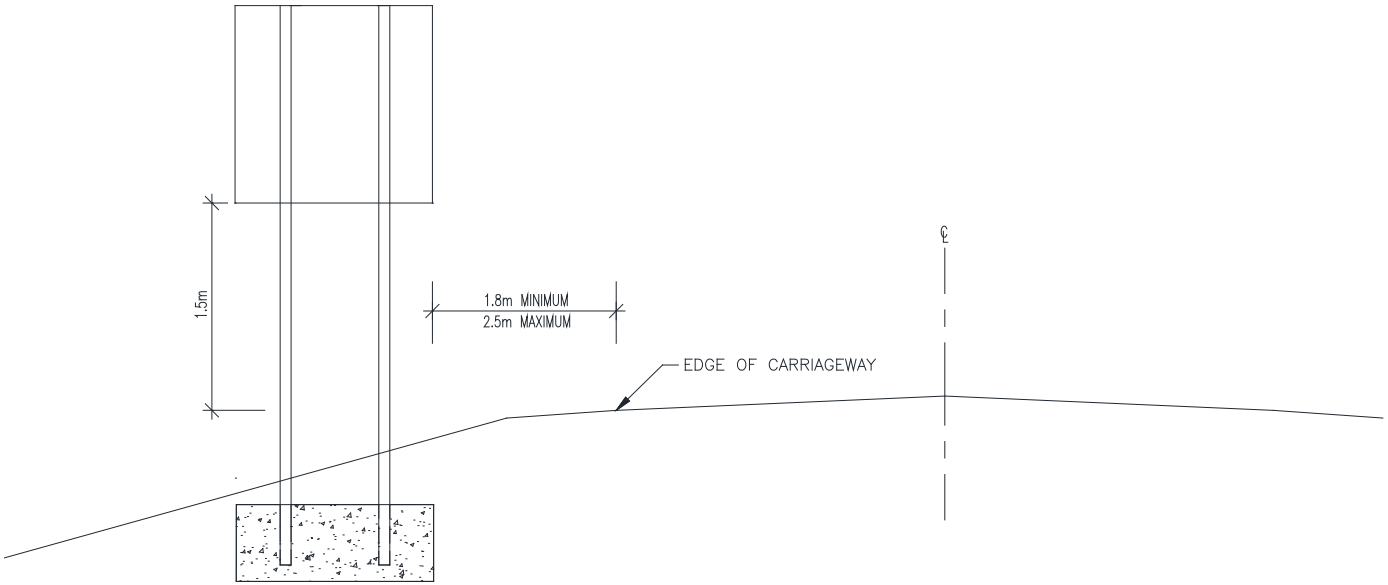
3.5 Chevron Sign Set-up Typical Detail



T-Junction Chevron reflective Sign (W63) to be installed at Masindi-Hoima Junction (*Traffic Signs Manual, Vol. 2; Ministry of Works, Housing, and Communications, 2004*). The dimensions are 400 x 1600 mm, mounted 1500mm above the ground level.

Long reflective Chevron sign (W61) of dimensions 400 x 1200mm to be used to mark identified dangerous sharp curves to enhance visibility of the road alignment at night (*Traffic Signs Manual, Vol. 2; Ministry of Works, Housing, and Communications, 2004*). Two posts as shown in the drawings below shall support the signs.





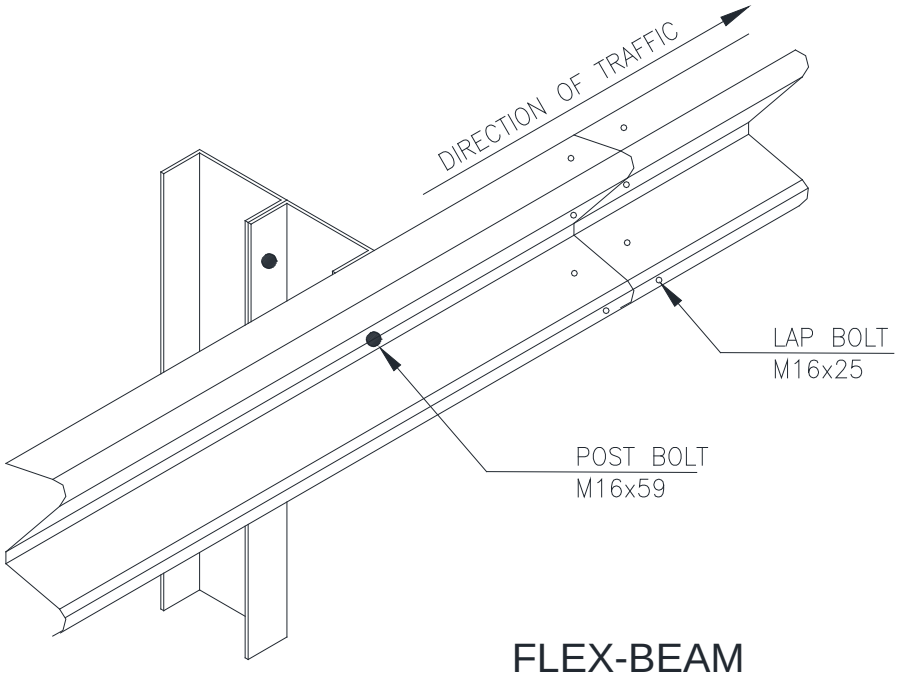
SIGN PLACEMENT

SCALE 1:50

NOTES:

1. FOOTING TO BE CLASS 15/20 CONCRETE
2. THE SIZE OF THE CONCRETE FOOTING WILL BE 0.45m x 0.45m
3. SIGN POST SHALL BE CYLINDRICAL, GALVANIZED STEEL OR SIMILAR APPROVED BY THE ENGINEER.
4. BOLTS TO BE BUTTON–HEADED STAINLESS OR GALVANISED STEEL. NUTS TO BE VANDAL PROOF BY EITHER SNAP–OFF HEXAGONS OR SPOT WELDED.

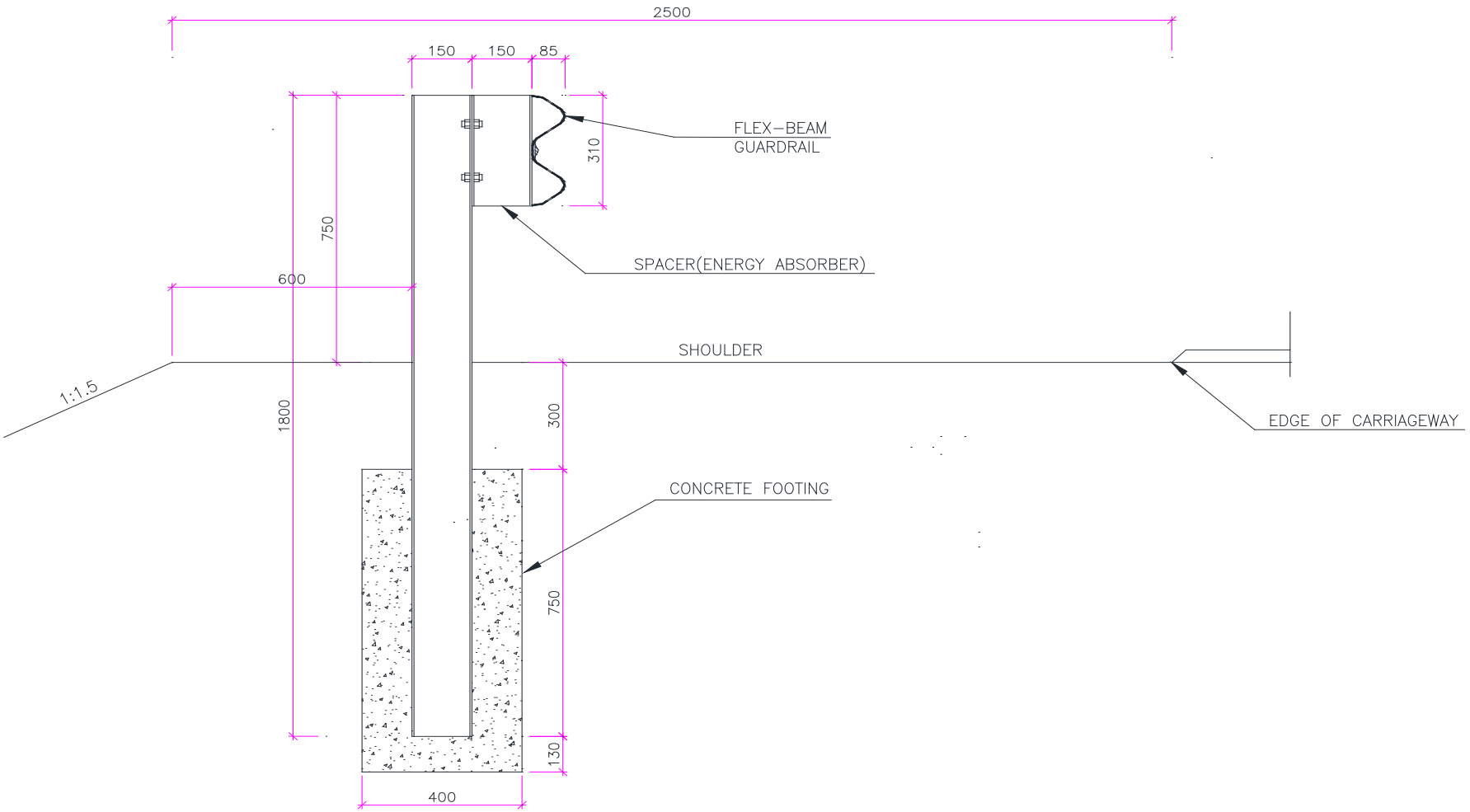
3.6 Steel Guard Rail Typical Details



FLEX-BEAM
JOINTS

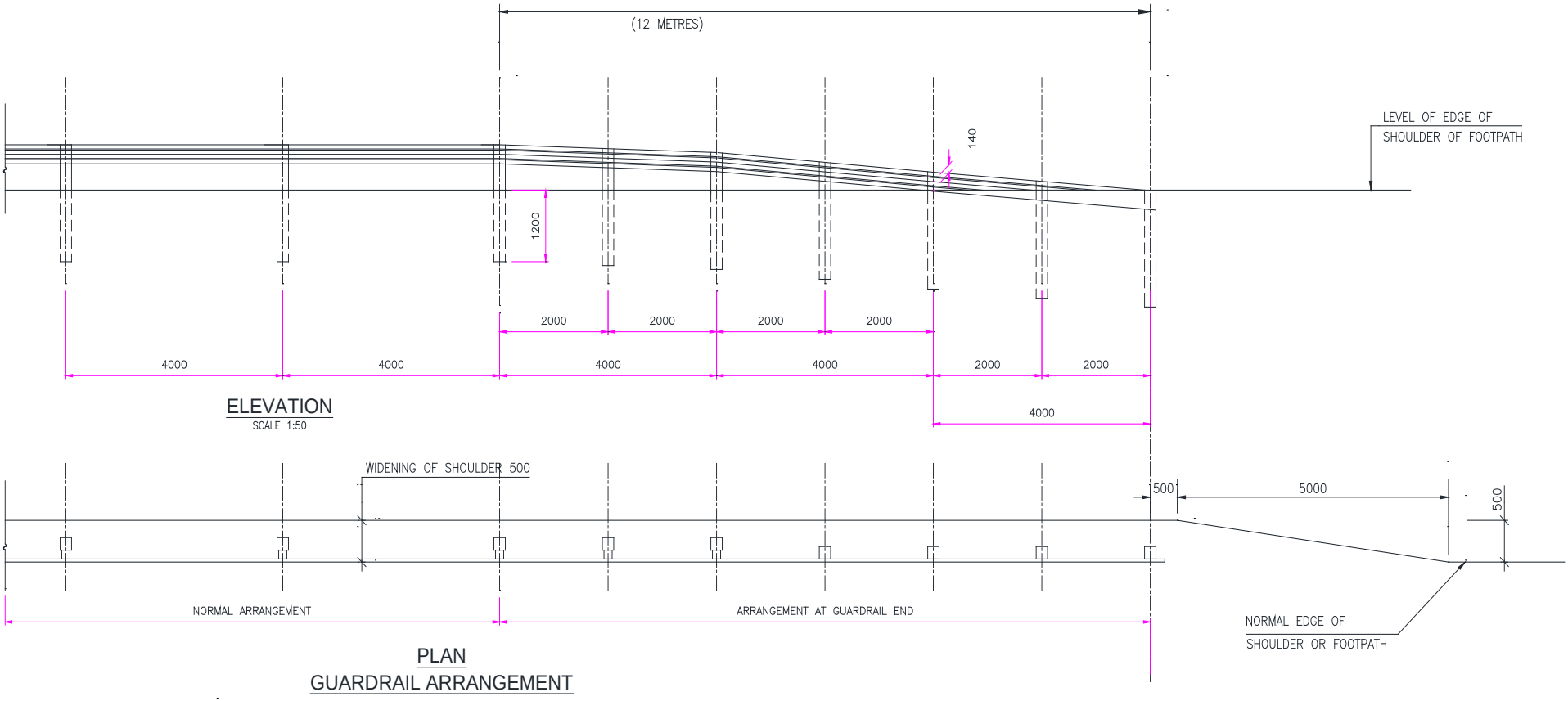
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
2. LAP GUARDRAIL SECTIONS IN DIRECTION OF TRAFFIC FLOW.
3. ALL BOLTS SHALL BE BUTTON–HEADED AND GALVANISED.
4. THE GUARDRAIL SHALL BE GALVANISED.
5. START AND END OF GUARDRAIL SECTION TO BE IDENTICAL.
6. COMPACTION AROUND POSTS TO BE THE SAME AS SURROUNDING EARTHWORKS.
7. NORMAL SHOULDER WIDTH TO BE INCREASED AS SHOWN WHERE GUARDRAIL IS REQUIRED.
8. ALL NUTS TO BE SPOT WELDED TO THE BOLT.
9. STANDARD UNITS ALSO TO BE USED ON THE END SECTIONS.
10. THE POST SHALL BE DUG INTO THE FILL BY METHOD APPROVED BY BY THE ENGINEER.
11. GUARDRAIL TO BE LOCATED AS DIRECTED BY THE ENGINEER
12. THE THICKNESS OF THE GUARDRAIL SHALL BE 3.0mm.



SECTION A-A

SCALE 1:10


(12 METRES)
LEVEL OF EDGE OF
SHOULDER OF FOOTPATH
140
1200
2000
2000
2000
2000
4000
4000
4000
4000
2000
2000
4000
ELEVATION
SCALE 1:50
WIDENING OF SHOULDER 500
500
5000
500
NORMAL ARRANGEMENT
ARRANGEMENT AT GUARDRAIL END
NORMAL EDGE OF
SHOULDER OR FOOTPATH
PLAN
GUARDRAIL ARRANGEMENT