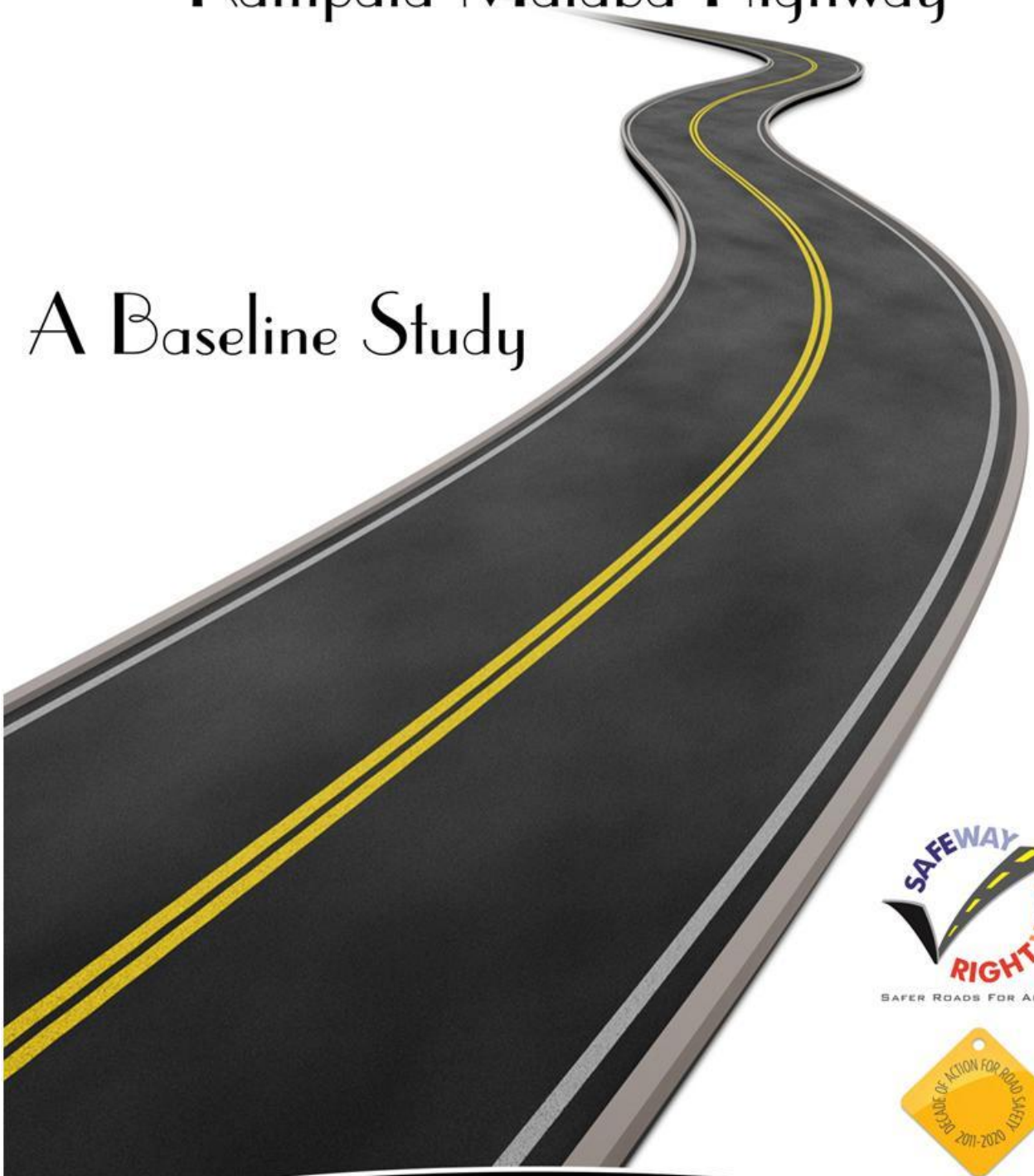
Road Safety Inspection of the Kampala-Malaba Highway

A Baseline Study



SAFEWAY RIGHTWAY
SAFER ROADS FOR AFRICA

DECADE OF ACTION FOR ROAD SAFETY 2011-2020

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EXECUTIVE SUMMARY

***Function Classification*:** Kampala-Malaba highway is part of the Northern corridor linking the coastal port of Mombasa in Kenya, Kampala, Uganda, Rwanda, Burundi, Democratic Republic of Congo and to a less extent South Sudan. It is the main import and export route by land from the East coastline at Mombasa, and thus very critical to economic development of Uganda. The terrain is generally flat from Malaba to Iganga and thereafter rolling up to Kampala. There are many long straight and level portions along Iganga-Malaba section than Iganga-Kampala. The maximum design speed for level and rolling terrain are 110 and 100 km/h respectively. The lane and shoulder widths are 3.50 and 2.00 meters respectively.

***Legal Low Speed Zones*:** There are several 50 km/h speed zones in-built-up areas along the highway namely; Tororo, Naluwere, Busia, Idudi, Busesa, Nakalama, Iganga Town, Church Missionary Society [CMS] Iganga, Bulanga, Mayuge Junction, Magamaga, Bugembe, Njeru, Mbiko, Lugazi, Namawojjolo, Mbalala, Mukono, Seeta, Namanve and Bweyogerere. In most of these towns, speed signs have been removed and pedestrian crossings faded under traffic action. Motorists are allowed to move at a maximum speed of 80 km/h for the rest of the highway. However, due to changing land use, several scattered settlements and roadside markets exist along this highway that are not marked and lack calming measures such as rumble strips and humps. These areas have a high risk of vehicle-pedestrian collisions and include Namataba, Kayanja, Namagunga, Kitigoma, Lugalambo, and Kitega.

***Vertical Elevation Changes*:** There is a gradual reduction in elevation from 1144 m around Tororo to 1154 m at Iganga, rising again to a peak of 1254 m at Nakibizi near Jinja Town. The elevations then drop between Lugazi and Mukono from 1216 m to 1201 m, before rising again up to Bweyogerere. The maximum, average and minimum vertical elevations are 1074 m, 1150 m and 1254 m respectively based on GPS route data. The implications of this fall and rise in elevations is on the expected speeding characteristics of vehicles, which has a bearing on the type of accidents that occur. Indeed as confirmed from reported accident data, the section between Tororo and Iganga is a high speed zone as well as that between Lugazi and Mukono. There is significant speed reduction due to rise in elevation between Iganga and Lugazi implying a high risk of overtaking maneuvers resulting in mostly likely head-on accidents.

***Horizontal Alignment*:** Available data for Mukono-Owen Falls Dam Section of the highway which is 54.20 km shows that there are 43 horizontal curves with radii ranging between 250 and 5680 metres. Only one horizontal curve has radius 495 meters below the specification for flat terrain but above threshold for rolling terrain (415 meters). Twenty four (24) horizontal curves have radii at most 700 meters. Therefore driving along Jinja-Mukono section requires full attention of the driver due to high likelihood of encountering many and shorter radii horizontal curves. These curves force the driver to adjust their approach speeds (decelerate) and accelerate

after exiting the curve. Failure to adhere to these geometric constraints could result in loss of control or roll of accidents.

***Traffic Volume*:** Traffic data was collected for two hours at four sections which were also blackspots namely; Busesa, Nakalama, Namasoga and Bulanga. Volume data extracted from videos in the two hours was grouped into vehicle categories as follows; saloon cars, taxis, 4 wheel drives [4WD] (including Prados, and pick-ups), trucks, buses, coasters and trailers (goods and fuel tanks) in respective direction of travel. The two hour directional volume data shows that the predominant vehicle category amongst passenger cars is taxis, and trailers in heavy vehicles. Traffic volume increases as you move between from Iganga to Jinja and beyond. Drivers in the section Iganga-Bugiri-Malaba have freedom to choose their speeds, and therefore a high likelihood of over speeding that may result in loss of control accidents. The relatively high volumes in the sections; Iganga-Jinja and Jinja-Kampala means drivers have less freedom to choose their own speeds and as such long queues behind slow vehicles develop. This situation increases the desire to overtake, which in turn increase the likelihood of head-on accidents.

Speeding Characteristics: The average speed of passenger cars is close to the legal speed limit of 80 km/h in rural sections although the maximum recorded speeds as significantly greater than the speed limit. The average speeds of heavy vehicles and motor cycles are lower than those passenger cars indicating variability in speeding environment by vehicle mix along the highway. This variability increases the desire to overtake as faster vehicles catch-up with slower vehicles. Secondly, speed data shows that 25% of all passenger cars move with speeds over and above 80 km/h and this difference is between 11-23 km/h in two travel directions and four stations. There is clearly a speeding problem especially of passenger cars that requires traffic police speed enforcement.

Reported Head-on and Loss of Control Accidents: Head-on and loss of accident data archived from New Vision and daily Monitor Newspapers in the period 2005 - 2010 inclusive were for 31 highways in Uganda. Highways with high traffic volumes also have the highest total accidents; Kampala-Jinja, Kampala - Masaka, Kampala - Gulu, Masaka - Mbarara, and Jinja - Iganga. On aggregate, Kampala-Jinja-Iganga-Bugiri section had a total of 41 head-on and loss of control accidents. Head-on accidents reported were 26 accidents and 15 were loss of control accidents with the highest proportion reported along Kampala-Jinja section. Frequently reported blackspots along this highway include; Kitigoma, Namawojjolo, Kitega, Sanga-Mabira, Najjembe, Bulyantete, Mukono, Namagunga, Mabira Forest, Kigombya, Church Missionary Society [CMS] Iganga and Kakira.

Reported Accident Causes: Reported causes of accidents along the highway were over speeding, improper overtaking; tire burst and reckless driving. Vehicle categories involved in loss of control accidents were mainly taxis, buses and passenger cars. Head-on accidents involved either a taxi, bus, passenger car and a trailer or more than one trailer. This observation is consistent with traffic and speeding characteristics with respect to speeding and overtaking.

Blackspots by Accident Type: Field inspections together with traffic police officers identified 67 blackspots in the section between Bweyogerere and Naluwere after Bugiri. These are known accidents spots along this highway according to traffic police with high annual frequency of accident occurrence. The blackspots were broadly grouped into three broad categories namely; speeding and overtaking (33 No.), Vehicle-Pedestrians in towns and trading centers (24 No) and Blackspots at school zones (10 No.).

Blackspots for High Speed and Overtaking Enforcement: Blackspots meant for speed and overtaking enforcement were selected based on available space for parking of stopped vehicles, visibility, previous enforcement record and reported frequency of occurrence of accidents. If funds are available and traffic police has a mobile unit, both speed and appropriate overtaking be enforced at all the thirty three blackspots. It is recommended that Safe Way Right Way together with traffic police enforce speed and appropriate overtaking at the following high priority sections; Rwenzori Factory Namanve, Walusubi, Kayanja, Namagunga, Kakira Sugar Factory, Mabira Rwankima, Kitega, Bulyantete, Nakalama, Butende Swamp, Busesa Swamp, and Gogero Swamp.

Built-up Areas for 50 km/h Speed Limit Enforcement: Vehicle-Pedestrian accidents were broadly divided into; (1) busy towns and (2) roadside Market. Long term measures were proposed for specific black spots and involved changes in geometric layout including installation of guard rails to limit pedestrian crossing in space, and building rumble strips and humps to control speeds. Sensitization at roadside market and towns will be carried out at; Namawojjolo, Lugazi, Najjembe, Lugalambo Mbiko, Iganga and Idudi. Safe Way Right Way will carry out sensitization to vendors and community on safe highway crossing and provision of marked reflector jackets.

Proposed Safety Measures at School Zones: Schools between Iganga and Bweyogerere that are located in heavily built up areas than those located between Iganga and Naluwerere that are mainly in a rural setting. Pupils walk for a long distance parallel to the road which increases the likelihood of being knocked by motorcycles that they share shoulders for space. The first safety intervention is for Safe Way Right Way to carry out road safety education in selected schools, train Traffic Guides, and provide reflector jackets and flags to aid crossing the road from the school compound. In addition, paint zebra crossing from the school gate. Install advance warning signs in both directions of travel and one at each crossing point. Selected schools include; (1) Church Missionary Society [CMS] Iganga consisting of Busoga University, , Canon Ibula Primary School, Demonstration School Clever Primary School Iganga Model School and Barclays School, (2) SDA Primary School Iganga and Tawfiq Islamic Primary School Buseyi, (3) All Saints Primary School Namataba, (4) Butende Islamic School, (5) St. Ann Vocational and Primary School Busowa, (6) Ndifakulya Primary School near Bugiri, (7) Lugazi Muslim Primary School, and (8) Idudi Moslem Primary School.

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PART I: INTRODUCTION

1.1 Background

This road safety inspection was initiated by Safe Way Right Way [SWRW] in an effort to identify high accident locations (blackspots) and suggest measures to mitigate some avoidable accidents particularly at high speed sections, school zones and towns/trading centers with high pedestrian volumes along Kampala – Malaba highway. The study commenced on 26th March, 2013 and was expected to end on 26th April 2013 with submission of a report. This report details the road safety inspection of existing 220 km Kampala-Malaba highway from Bweyogerere Interchange at the end of Northern Bypass next to Mandela National Stadium to Malaba Border Post. It covers identified blackspots along the highway, traffic mix and speeding characteristics at selected stations and the proposed safety interventions. Safety concerns along the highway were broadly categorized into: (1) speeding and overtaking problem zones, (2) trading centers high pedestrian volumes and (3) school zones. Specific sections were studied and recommendations made on how to enhance safety at respective sections considering both short and long term measures. The study serves as a basis to understand the extent of road traffic accident problem along the highway and form a basis for future safety interventions. Specifically, SWRW enforcement and road user education so as to increase awareness on various road safety issues and build partnerships with local authorities for sustainable road safety environment amongst affected communities.

1.2 Study Objectives

Assess safety of Kampala-Malaba highway based on geometric, user and accident characteristics by identifying high accident risk locations and suggesting possible interventions. The following data was collected at identified accident spots along the highway to better understand causal factors and propose mitigation measures;

- Infrastructure characteristics: signs and markings at critical sections such as town crossings, medians, pedestrian crossings, guard rails, passing zones and schools.
- Geometric attributes -. horizontal/vertical curves, elevations, and junctions details
- User characteristics: traffic volume, speeds, mix by type and mode by proportion, high pedestrian crossing locations, accident and severity data, accident type and location, accident severity – injuries and fatalities, and types of vehicles involved.

1.3 Inspection Team

The road safety inspection was carried out by a team of three persons with Godfrey Mwesige as the Team Leader and a specialist in safety inspections; Mr. Andrew Zirimenya a safety and geometric assistant and Mr. Drake Bagyenda as drafting and GIS specialist. The team has

experience in safety inspections from operational perspective involving traffic, roadside environment and geometric interactions that result in accidents.

1.4 Data Collection: Procedure, Tools and Methods

1.4.1 Procedure

The procedure adopted for data collection in this study is presented in Figure 1. Initially the Team Leader briefed the other member the task at hand and availed the relevant literature for the assignment including manuals and standards such as '*Safety Audit Manual'* by Ministry of Works, Housing and Communications (2004) and '*Manual of Road Safety Audit'* by Gaardbo & Schelling (1997) and "*The handbook of Road Safety Measures*" by Elvik, et al. (2009). A permission letter was drafted and delivered to Police to allow access to accident data and field inspections with traffic police personnel at respective stations. Preliminary visits were made by the Team Leader and the Safety Assistant at police stations along the highway to schedule for field inspections. Field inspections were then carried out according to schedule availed at respective stations, particularly identifying blackspots, nature of accidents that occur, time of day and common reported causes. Photo graphs were taken of this blackspots and GPS coordinates. In addition, geometric and traffic data collection was carried out at four selected stations and a video log of the highway in two directions of travel.

Figure 1: Inspection Procedure Adopted for this study

1.4.2 Tools and Methods

The data required for this baseline study was categorised into; geometric, accident and traffic. Tools and methods of data collection were specific for respective data category. Geometric data pertaining to general terrain and design features was obtained from accessible as-built drawings of the highway sections and use of hand-held GPS Oregon 550t with the capability to obtain elevations and speed while driving through the highway. This data was used to locate sections of the highway prone to speeding by virtue of terrain and how speeding characteristics relate to reported accident occurrences.

Figure 2: Traffic Data Collection Tools and Field Set-up

The second category of data collected was traffic data including vehicles per hour per direction and speeds of individual vehicles. This data was further classified by type; motor cycles, passenger cars and heavy vehicles. The data was collected at four stations namely; Busesa, Nakalama, Bulanga, and Namasoga along Jinja - Iganga - Bugiri section. It was not possible to collect data along Bugiri-Malaba section, and Jinja-Kampala sections due to on-going construction works and uneven surface. The data was collected using pneumatic tube classifiers and camcorders (see Figure 2).

The third category of data collected was accident types and location of blackspots along the highway. Blackspots were identified through joint field inspection with traffic police officers at police station along the highway. Data collected at the blackspots included GPS coordinates, nature of accidents; head-on, loss of control, pedestrian-vehicle accidents, or motorcycle-vehicle accidents. In addition, possible causes of the accidents were also determined from visual inspection and the experience of traffic police officers. Accident data was also archived from reports in New Vision and Daily Monitor 2005-2010 by road name, type of accident and number of fatalities and injuries. The outputs include; a table describing all blackspots along the project road and route map of the same.

PART II: GENERAL HIGHWAY INFORMATION

2.1 Functional and Geometric Class

Kampala-Malaba highway is part of the Northern corridor linking the coastal port of Mombasa in Kenya, Kampala, Uganda, Rwanda, Burundi, Democratic Republic of Congo and to a less extent South Sudan. It is the main import and export route by land from the East coastline at Mombasa, and thus very critical to economic development of Uganda. The highway functional classification according to Ministry of Works and Transport (2010) Geometric Design Manual, Vol. I; is a National Road Class Ib paved and Functional Class A. The terrain is generally flat from Malaba to Iganga and thereafter rolling up to Kampala. There are many long straight and level portions along Iganga-Malaba section than Iganga-Kampala. The maximum design speed for level and rolling terrain are 110 and 100 km/h respectively. The lane and shoulder widths are 3.50 and 2.00 meters.

The highway goes through non-inhabited areas (rural) with legal speed limit of 80 km/h and in built-up areas 50 km/h according to the *Highway Code 2004* by Ministry of Works Housing and Communications (2004). Major 50 km/h speed zones along the highway namely; Tororo, Naluwere, Busia, Idudi, Busesa, Nakalama, Iganga Town, Church Missionary Society [CMS] Iganga, Bulanga, Mayuge Junction, Magamaga, Bugembe, Njeru, Mbiko, Lugazi, Namawojjolo, Mbalala, Mukono, Seeta, Namanve and Bweyogerere. In most of the towns, speed signs have been removed and pedestrian crossings faded under traffic action. However, due to changing land use, several scattered settlements and roadside markets exist along this highway such as Namataba, Kayanja, Namagunga, Kitigoma, Lugalambo, and Kitega among others. These increase the likelihood of vehicle-pedestrian collisions resulting in fatal accidents.

2.2 Geometric Alignment Description

The alignment profile of highway was obtained using GPS tracking between Malaba and Bweyogerere. The overlay of the track onto Google Earth Map is shown in Figure 3 with elevation plots in red and speed profile in blue colour. General observation from the alignment profile is that there is a gradual reduction in elevation between Tororo (1144 m) and Iganga (1154m) and a rise thereafter to a peak of 1254 m near Nakibizi after Jinja Town. The elevations further drop between Lugazi and Mukono from 1216 m to 1201 m, and rise again up to Bweyogerere. The maximum, average and minimum vertical elevations are 1074 m, 1150 m and 1254 m respectively.

The fall and rise in elevations has an effect on the expected speeding characteristics of vehicles and a huge bearing on the type of accidents that occur. Low elevation between Tororo and Iganga makes the section a high speed as well as that between Lugazi and Mukono with a high likelihood of loss of control accidents. This can be observed from the speed profile in Figure 3. Furthermore, there is a significant speed reduction between Iganga and Lugazi, and Mukono-Bweyogerere partly due to rise in elevation. Speed reduction increases the likelihood of fast

vehicles (mainly passenger cars) to overtake slow vehicles (mainly heavy vehicles) and therefore head-on accidents. If more head-on accidents were recorded by traffic police between Iganga and Lugazi should not be surprising. This will be checked against available accident statistics.

The section between Tororo and Busia Junction is sparsely populated compared to that between Iganga and Kampala. It is likely that vehicles will often encounter pedestrians and vehicles from accesses. The expectation from observation is that vehicle-pedestrian accidents are higher between Iganga - Kampala compared to Iganga – Malaba sections.

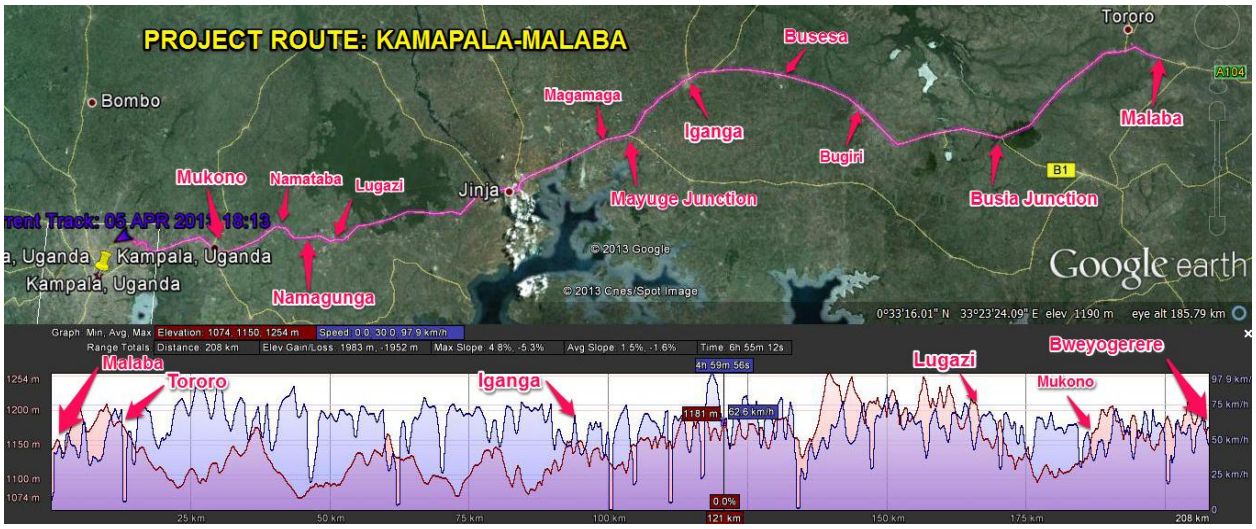


Figure 3: Track, Elevation and Speed Profile for Kampala-Malaba Highway (*GPS track overlay on Google Earth Map***)**

Geometric alignment data from Uganda National Roads Authority[1] for Mukono-Owen Falls Dam section (54.20 km) of the highway shows that there are 43 horizontal curves with radii ranging between 250 and 5680 metres. This is equivalent to a horizontal curve per kilometre of highway. Driving along Jinja-Mukono section requires full driver attention navigate the horizontal curves as well as ascend the vertical elevation observed earlier. The curves force the driver to adjust their approach speeds (decelerate) and accelerate after exiting the curve. Failure to adhere to this geometric requirement could result in loss of control or roll of accidents.

The section between Owen Falls Dam and Bugiri is 73 km long and 72 horizontal curves. However, unlike Mukono-Owen Falls Dam section, there are fewer curves (9 No) with radii less than 530 meters for a flat terrain. Other horizontal curves have radii up to 30,000 meters. This alignment does not require significant driver effort to navigate safely. Alignment drawings for sections Kampala-Mukono and Bugiri-Malaba were not yet available at the time of compiling this report. However, the general alignment description in Figure 3 is sufficient enough to identifying sections with speeding problem in absence of this data.

[1] Alignment Data obtained from Geometric drawings of the Staged Reconstruction of Mukono-Jinja Road Project.

2.3 Traffic Volume and Speed Characteristics

2.3.1 Directional Traffic Volume

Traffic data was collected for two hours at four blackspots namely; Busesa, Nakalama, Namasoga and Bulanga. Volume data extracted from videos in the two hours was grouped into vehicle categories as follows; saloon cars, taxis, 4 wheel drives [4WD] (including Prados, and pick-ups), trucks, buses, coasters and trailers (goods and fuel tanks) in respective direction of travel. Figure 4 shows that the predominant vehicle category amongst passenger cars is taxis, and trailers amongst heavy vehicles. This is expected given the primary function of this highway. The proportion of trailers is high due to the fact that the highway is an export/import route from the sea port of Mombasa. In addition, taxis are the primary public transport along the route. A few buses were observed at Namasoga and Bulanga probably coming from Mbale and beyond.

The reader should also note that traffic volume in two hours at Nakalama and Busesa is lower than that at Namasoga and Bulanga. The reason for this is the fact that Namasoga and Bulanga sections are located between Iganga and Jinja. Iganga is a big eastern town with high locally generated traffic destined for Jinja and Kampala. Secondly, these sections also include merged traffic from Mbale and the North East. The implication of this change in proportion of traffic volume is that drivers have freedom to choose their speeds and therefore a high likelihood to over speed resulting in loss of control accidents. The relatively high volumes in the sections; Iganga-Jinja and Jinja-Kampala means drivers have less freedom to choose their own speeds and as such long queues behind slow vehicles can be observed. This situation increases the desire to overtake, which in turn increase the likelihood of head-on accidents.

2.3.2 Speed Characteristics

Figure 5, 6, 7, 8 and 9 show speeding characteristics at four selected stations in three broad vehicle categories namely: passenger cars (saloon, 4WD and taxis), motorcycles and heavy vehicles (trucks, buses, coasters and trailers). The mean speed of passenger cars is close to the speed limit of 80 km/h and assuming normal distribution; then more than 50% of observed vehicles had speeds in excess of the speed limit. The average speeds of heavy vehicles and motor cycles are lower than those passenger cars indicating variability in speeding environment by vehicle mix. This variability increases the desire to overtake as faster vehicles catch-up with slower vehicles. This difference can be observed in Figure 9 which is a boxplot showing speed distribution by vehicle category in two directions at four sections.

As a guide to interpreting the boxplot, the thick middle line shows location of the mean, lower and upper lines of the rectangle show the 25th and 75th percentile speeds respectively. 75th percentile speeds indicate the speed not exceeded by 75% of observed vehicles. That is, only 25% of observed vehicles had speeds in excess of 75th percentile speed. The width of the rectangle shows how variable the speeds are for the vehicle category. The dotted vertical line shows the upper extent of normal speeds. Values above this line show speeds in excess of normal speeds for the vehicle category, also referred to statistically as outliers or simply put excessive

speeds. Note in the plots that the mean speed of passenger cars is consistently higher than the other two, and more variable due to wider rectangle. Passenger cars have outliers representing excessive speeds. The 75th percentile speed is above 80 km/h indicating with certainty that 25% of all observed passenger cars had speeds in excess of the speed limit.

In traffic engineering perspective, the 85th percentile speed should be close or equal to speed limit for the highway. The 85th percentile speed for passenger cars at Bulanga by travel direction is 103 km/h (Towards Iganga) and 91 km/h (Towards Jinja). At Namasoga the 85th percentile speeds are 95 km/h (Towards Iganga) and 93 km/h (Towards Jinja). At Nakalama the 85th percentile speeds are 92 km/h (Towards Bugiri) and 91 km/h (Towards Iganga). At Busesa the 85th percentile speeds are 92 km/h (Towards Bugiri) and 92 km/h (Towards Iganga). The 85th percentile speeds of passenger cars at the four stations exceed the speed limit by 11-23 km/h. The conclusion from this finding from the data is that passenger cars grossly violate 80 km/h speed limit.

The above analysis shows that there is an existing problem of excessive speeds amongst passenger cars which is consistent at all the four stations in two directions. There is need for speed enforcement at high speed sections. Therefore enforcement measures should be directed towards making the speeding characteristics of passenger cars consistent and close to the speed limit of 80 km/h. The goal of the enforcement is to reduce observed 85^{th} percentile speed of passenger cars by 10-15 km/h.

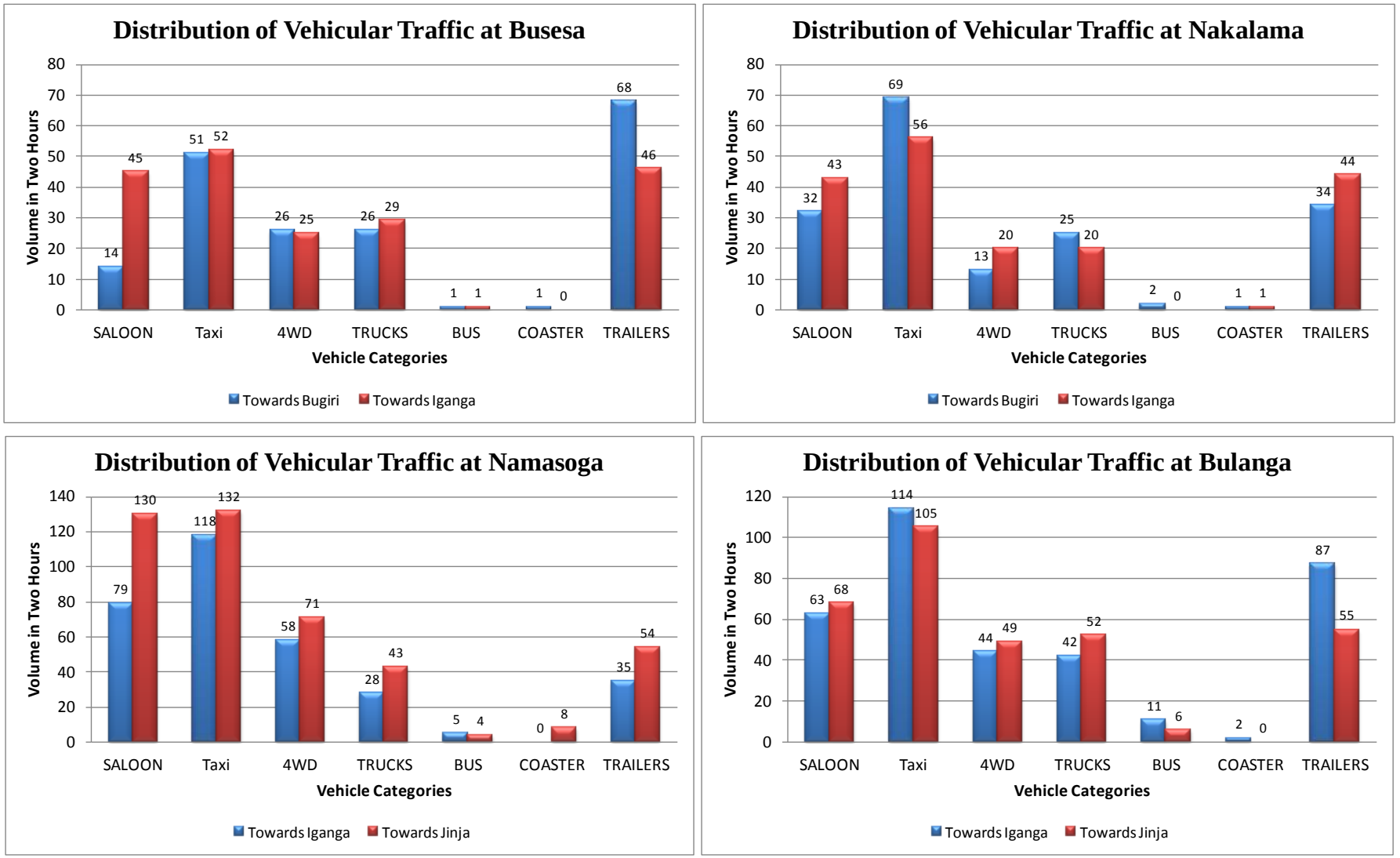
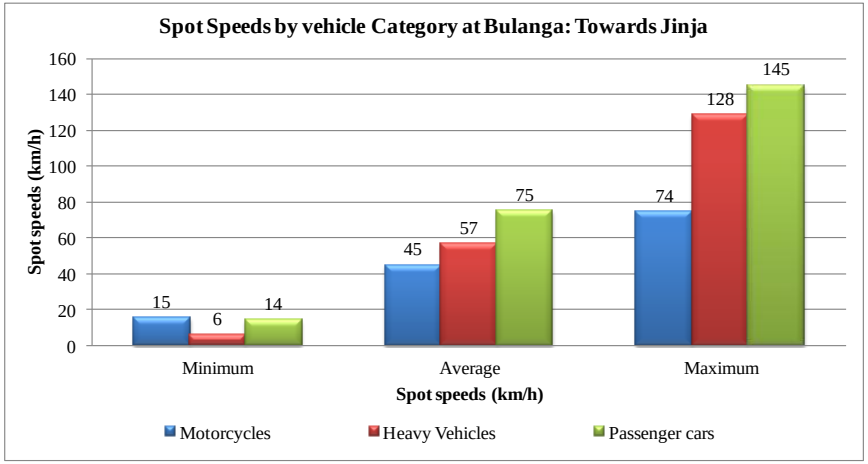


Figure 4: Two-hour Traffic Volume in Two Directions at Four Stations along the Highway



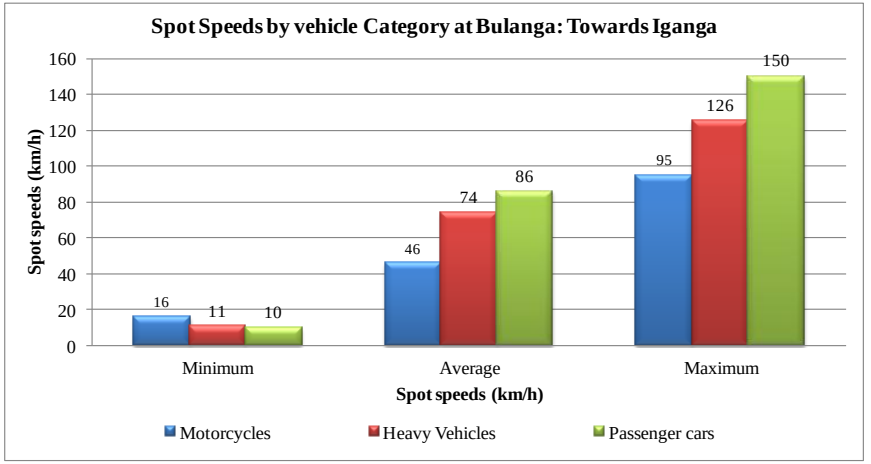
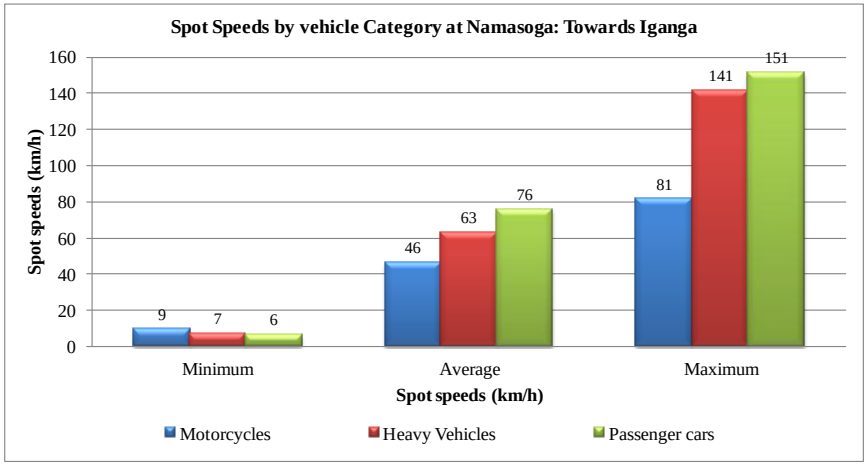


Figure 5: Spot Speeds by Vehicle Category in Two Directions at Bulanga



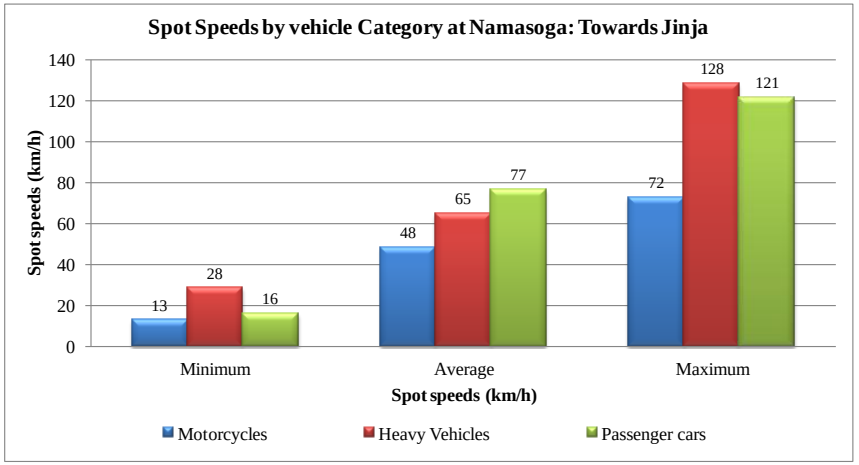
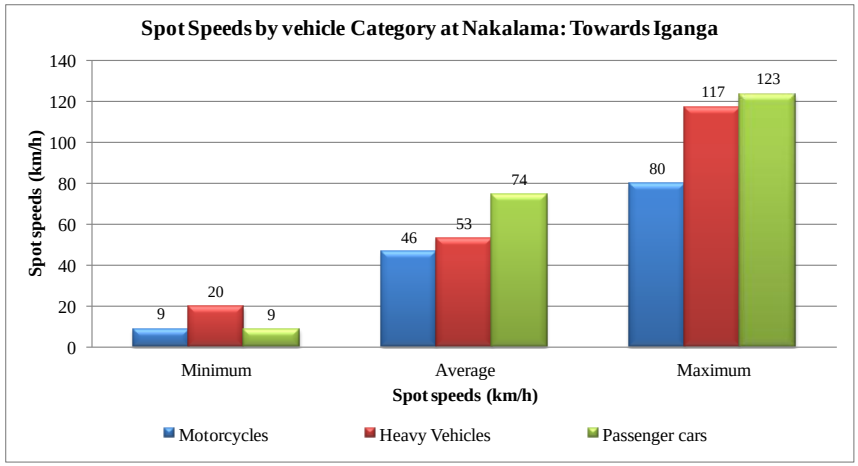


Figure 6: Spot Speeds by Vehicle Category in Two Directions at Namasoga



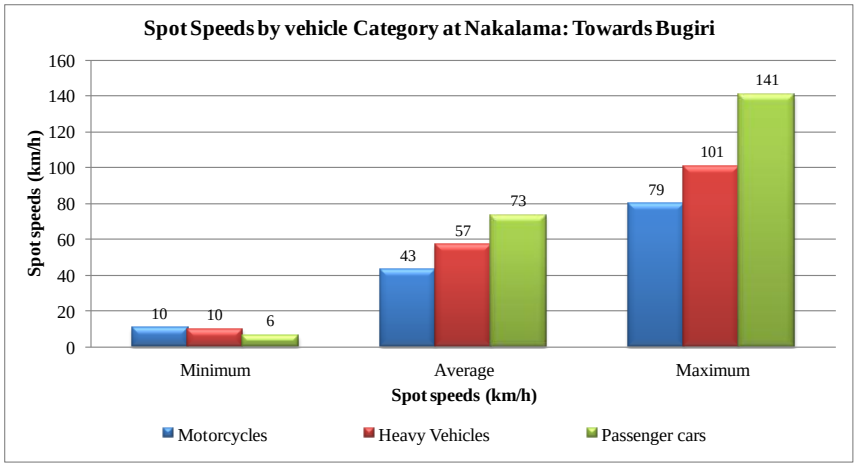
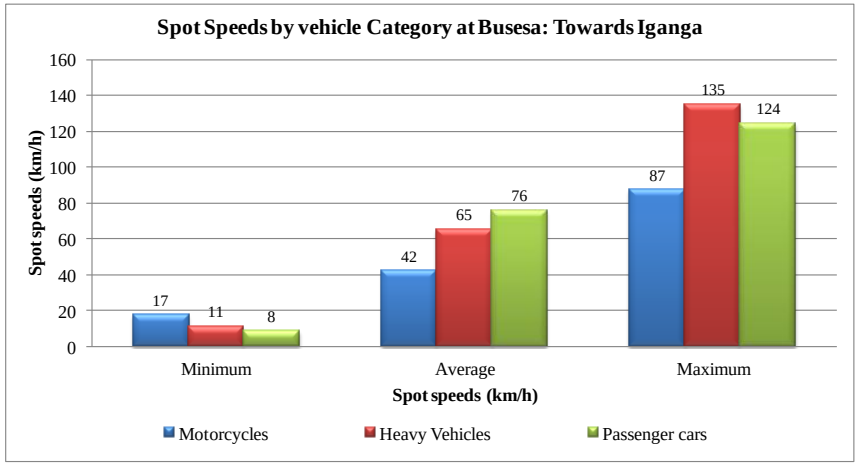


Figure 7: Spot Speeds by Vehicle Category in Two Directions at Nakalama



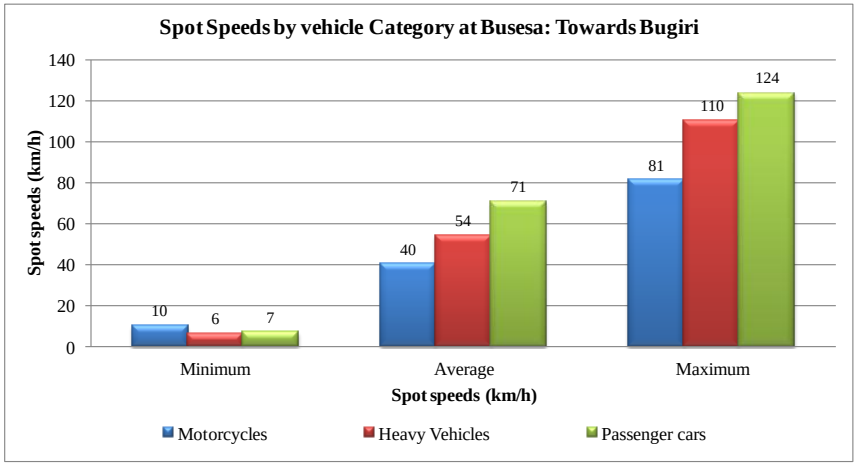


Figure 8: Spot Speeds by Vehicle Category in Two Directions at Busesa

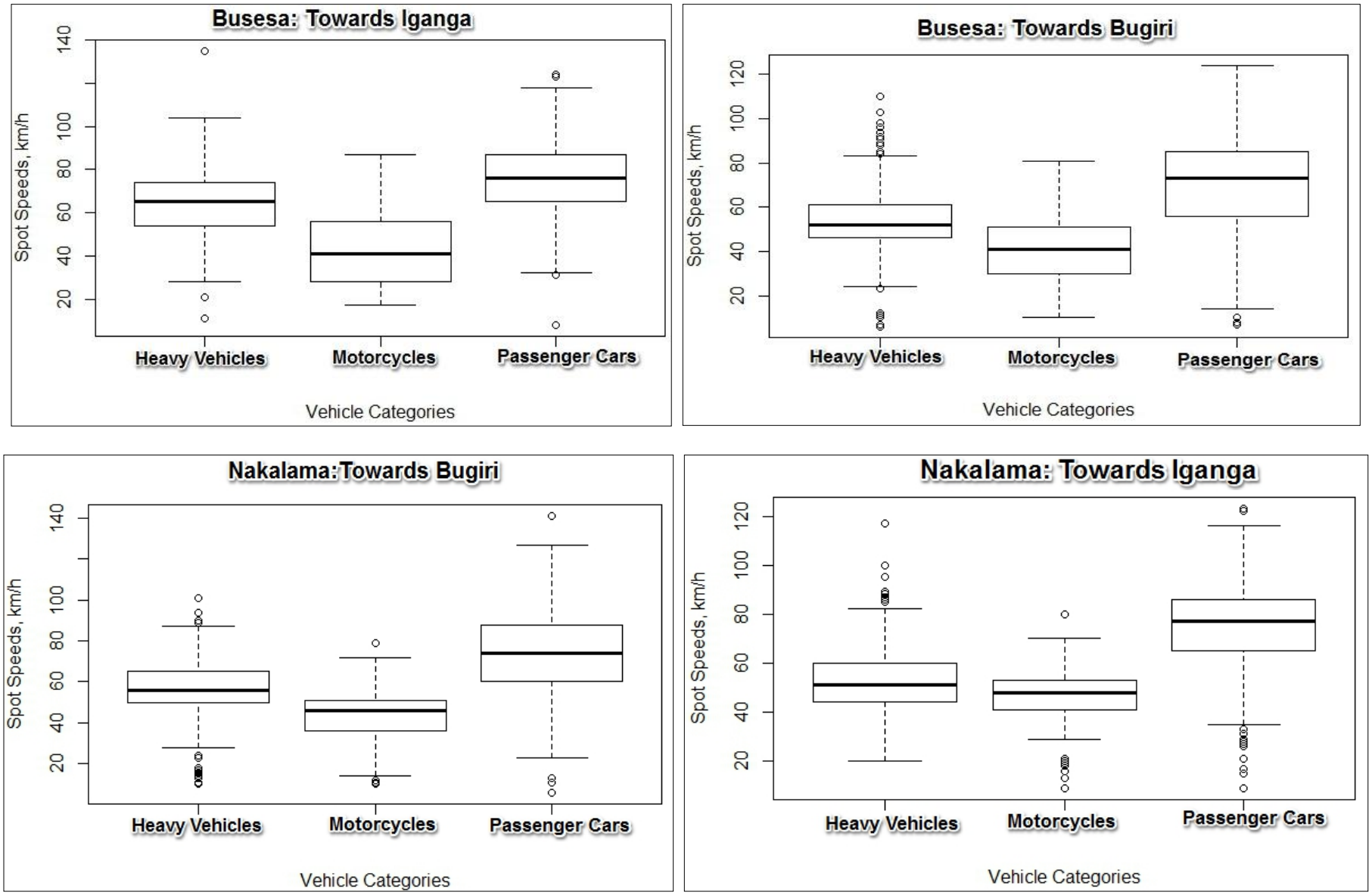


Figure 9: Boxplots for Speed Distribution by Vehicle Category

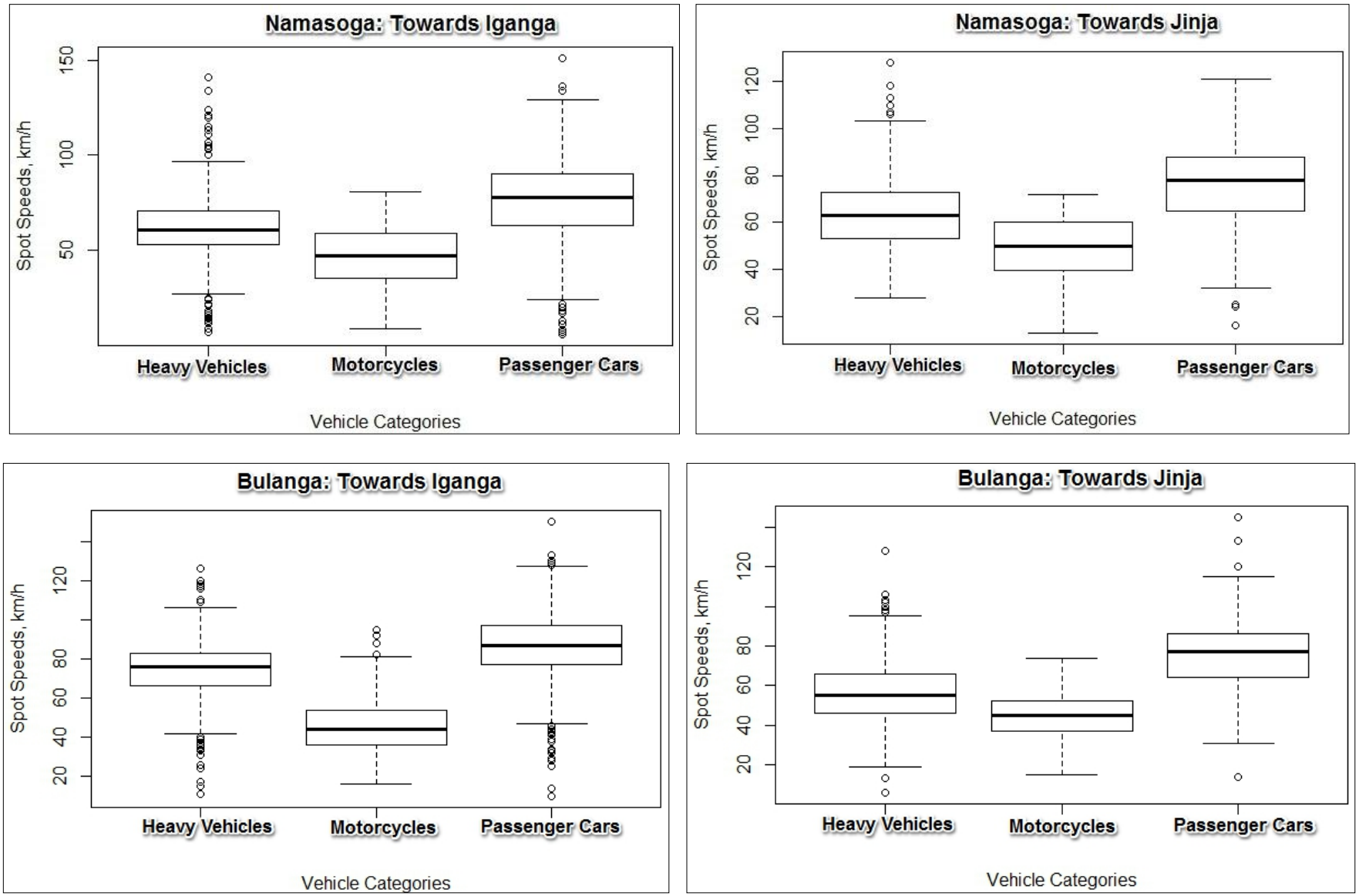


Figure 9: Continued

PART III: ACCIDENT STATISTICS AND BLACKSPOTS

3.1 National Accidents Statistics

National traffic accident data from Uganda Police Force for the period 2006-211 shows a gradual increase in the total number of reported accidents by severity; fatal, serious and minor injury (Figure 10). Particularly, fatal and serious injury accidents have mostly been attributed to over speeding, reckless/dangerous driving; careless driving and dangerous loading (see Table 1). The year 2008 shows a dip across three severities. This could be attributed to safety actions carried out by Uganda Police Force that year such as enforcing the speed limit and highway patrol.

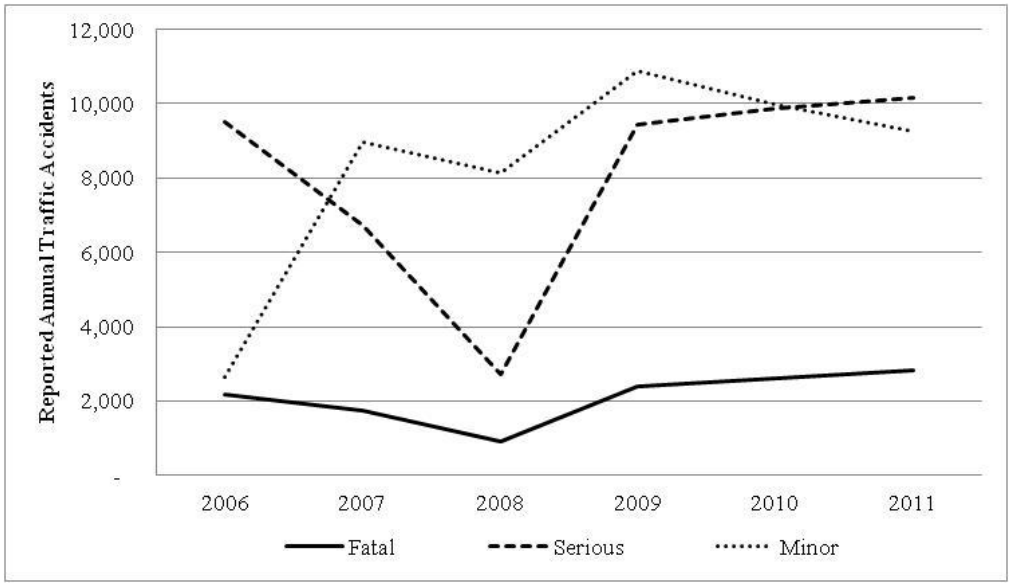


Figure 10: Reported Annual Traffic Accident Statistics by Uganda Police Force (Statistical Abstract 2010, 2011 & 2012)

Table 1: Reported Causes of Road Traffic Accidents by Uganda Police Force (*Source: Statistical Abstract 2010, 2011 & 2012***)**

Cause of Accidents	2009	2010	2011
Careless Driving	9112	9,316	8,659
Reckless/Dangerous Driving	6148	6,579	6,514
Unknown Cause (Hit & Run)	2057	2,129	1,818
Careless Pedestrian	889	881	1,141
Vehicle Mechanical Defects	738	720	929
Over speeding	*973*	*839*	*867*
Passenger falls from vehicle	228	238	501
Under influence of drinks/drugs	249	194	299
Obstacle on the carriageway	96	76	266
Dazzled by lights of another car	85	114	152
Overloading/Dangerous loading	202	240	113
Other Causes	1122	1,135	1,013
Total	**21,899**	**22,461**	**22,272**

3.2 Blackspots Identification from Reported Accidents Data

National aggregate traffic accident data lack location attributes necessary to identify blackspots along the highway in this study. The reason for this is that traffic police does not have appropriate infrastructure for data collection, storage and retrieval for dissemination. The exercise to develop a national accident database with appropriate infrastructure is on-going under Ministry of Works and Transport funded by the World Bank. Therefore two methods were employed to obtain data on blackspots along the highway namely; six-year reports in past daily news papers (2005-2010) and field inspections with Traffic Police at respective stations.

3.2.1 Accident Statistics from Newspapers

Head-on and loss of accident data archived from New Vision and Daily Monitor newspapers in the period 2005-2010 inclusive are summarized in Table 2 for 30 National and District Roads in Uganda. The data was arranged in descending order according to total number of head-on and loss of control accidents. Roads with high traffic volumes also have the highest total accidents; Kampala-Jinja, Kampala-Masaka, Kampala-Gulu, Masaka-Mbarara, and Jinja-Iganga. On aggregate, Kampala-Jinja-Iganga-Bugiri section had a total of 41 head-on and loss of control accidents. Head-on accidents reported were 26 accidents and 15 were loss of control accidents. The highest proportion was reported along Kampala-Jinja section and the causes of traffic accidents were; over speeding, improper overtaking, tire burst and reckless driving (see Table 3).

Still from Table 3, the most frequently reported blackspots along the study highway include; Kitigoma, Namawojjolo, Kitega, Sanga-Mabira, Najjembe, Bulyantete, Mukono, Namagunga, Mabira Forest, Kigombya, Church Missionary Society [CMS] Iganga and Kakira. Loss of control accidents mainly involved taxis (omnibuses), buses and other passenger cars. Head-on accidents involved either a taxi, bus, passenger car and a trailer or more than one trailer. This observation is consistent with traffic and speeding characteristics with respect to speeding and overtaking discussed under general highway alignment. For instance, most loss of control accident occurred in a section between Iganga and Bugiri that also has low hourly traffic volume. Head-on accidents mostly occurred in the section between Iganga and Kampala. These were consistent with hourly traffic volume analysis and rising elevation. It is clear from reported accident data that this highway has known blackspots where accidents frequently occur and therefore require corrective measures. These blackspots are concentrated along Kampala-Jinja section of the highway.

3.2.2 Field Inspections

Field inspections conducted with support from traffic police officers identified 67 blackspots in the section between Bweyogerere and Naluwere after Bugiri. The blackspots between Kampala and Jinja were consistent with those obtained from newspaper archives. These are known accidents spots along this highway according to traffic police with high annual frequency of accident occurrence. These blackspots were further broadly grouped into three categories by nature of accidents that occur namely; (1) speeding and overtaking, (2) Vehicle-Pedestrian and (3) Occurring at school zones. These are discussed in detail in subsequent sub-sections.

Table 2: Reported Head-On and Loss of Control Accidents by Highway 2005-2010 Inclusive (*Archived from New Vision and Monitor Newspapers***)**

No	Road Name	6-year Head-on Accidents	6-year deaths for Head-on	6-year loss of control accidents	6-year deaths for loss of control	Total 6-year accidents	Total 6-year Deaths
1	Kampala-Jinja	19	95	12	43	31	138
2	Kampala-Masaka	17	107	6	24	23	131
3	Kampala-Gulu	7	42	10	30	17	72
4	Masaka-Mbarara	5	3	5	36	10	39
5	Jinja-Iganga-Bugiri	7	25	3	4	10	29
6	Mbarara-Kabale	3	6	4	11	7	17
7	Kampala-Entebbe	4	5	1	3	5	8
8	Kasese-Fort Portal	1	12	2	10	3	22
9	Mbarara-Bushenyi	3	10	0	0	3	10
10	Arua-Koboko	1	1	2	0	3	1
11	Kabale-Katuna	2	31	0	0	2	31
12	Mityana-Mubende	1	7	1	18	2	25
13	Kampala-Mityana	1	3	1	20	2	23
14	Iganga-Mbale	0	0	2	16	2	16
15	Mubende-Fort Portal	1	7	1	3	2	10
16	Dokolo-Juba	2	2	0	0	2	2
17	Kapchorwa-Sironko	0	0	1	30	1	30
18	Pakwach-Nebbi	0	0	1	8	1	8
19	Arua-Pakwach	0	0	1	6	1	6
20	Mubende-Kagadi	0	0	1	6	1	6
21	Musita-Namayingo	1	6	0	0	1	6
22	Mbale-Kumi	1	4	0	0	1	4
23	Mbale-Soroti	0	0	1	4	1	4
24	Kipsukunya-Nakapiripirit	0	0	1	3	1	3
25	Mbale-Tororo	1	3	0	0	1	3
26	Kiboga-Hoima	1	2	0	0	1	2
27	Oyam Road	1	2	0	0	1	2
28	Gulu-Pader	0	0	1	1	1	1
29	Karuma-Pakwach	0	0	1	1	1	1
30	Pakele-Adjumani	0	0	1	1	1	1

Table 3: Reported Traffic Accident Statistics along Kampala-Malaba Road (2005-2010)

No	Day Reported	Date Reported	Road Name	Village	Type of accident	Number of vehicles	Type of vehicles	Reported cause of accident	Number of Deaths	Number of Injuries
1	Tue	15-Mar-05	Jinja-Tororo	Namasere	Loss of control	1	Omnibus	Overspeeding	11	5
2	Sun	15-May-05	Kampala-Jinja	Kitigoma	Head-on	2	Omnibus+semi-Trailer	overtaking	2	-
3	Fri	27-May-05	Kampala-Jinja	Namawojjolo	Head-on	2	car+omnibus	Overspeeding	5	10
4	Tue	19-Jul-05	Kampala-Jinja	sanga-mabira forest	Head-on	2	car+car	overtaking	3	-
5	Wed	31-Aug-05	Kampala-Jinja	Najjembe	Head-on	2	omnibus+truck	Overspeeding	4	9
6	Mon	31-Oct-05	Kampala-Jinja	Bulyantete	Head-on	2	omnibus+tractor	Overspeeding	8	28
7	Wed	14-Dec-05	Jinja-Bugiri	bugiri	Loss of control	1	bus	-	-	-
8	Wed	4-Jan-06	Kampala-Jinja	Najjembe	Head-on	2	bus+tractor	Overspeeding	7	19
9	Mon	9-Jan-06	Jinja-Iganga	-	Loss of control	1	trailer	poor visibility	1	-
10	Thu	12-Jan-06	Kampala-Jinja	Kauga	sideswipe	2	car+truck	Overspeeding	0	1
11	Sat	28-Jan-06	Kampala-Jinja	Kigunga	Head-on	2	truck+semi-trailer	overtaking	1	Several
12	Sat	1-Apr-06	Jinja-Iganga	Namasoga	Head-on	2	semi-traile+omnibus	-	5	7
13	Sun	2-Apr-06	Kampala-Jinja	Kireka	Loss of control	1	trailer	brake failure	0	0
14	Sun	2-Jul-06	Kampala-Jinja	Lugogo	Loss of control	1	trailer	-	-	-
15	Sat	8-Jul-06	Kampala-Jinja	owen falls dam	Loss of control	2	bus+lorry	-	1	4
16	Tue	1-Aug-06	Kampala-Jinja	Kitega	Head-on	2	omnibus+trailer	Overspeeding	30	5
17	Mon	14-Aug-06	Kampala-Jinja	Namagunga	Head-on	4	trailer+truck+omnibus+car	Overspeeding	6	10
18	Tue	15-Aug-06	Kampala-Jinja	Kireka	Loss of control	1	trailer	-	0	2
19	Tue	19-Sep-06	Kampala-Jinja	Mabira Forest	Loss of control	2	bus+omnibus	tree on the road	1	49
20	Tue	10-Oct-06	Kampala-Jinja	Kakawa	Loss of control	1	car	Overspeeding	1	-
21	Thu	16-Nov-06	Jinja-Iganga	Waina	Head-on	2	Omnibus+Car	-	-	14
22	Tue	5-Dec-06	Jinja-Iganga	Nalubabwe	Head-on	2	lorry+omnibus	Overspeeding	3	12
23	Mon	8-Jan-07	Kampala-Jinja	Namboole	Loss of control	1	trailer	Overspeeding	-	2
24	Tue	23-Jan-07	Jinja-Iganga	Wandago	Head-on	2	lorry+mini-bus	-	6	15
25	Sat	27-Jan-07	Kampala-Jinja	Najjembe	Head-on	2	truck+car	Overspeeding	2	-
26	Sat	31-Mar-07	Kampala-Jinja	Lugogo Bypass	Head-on	2	lorry+truck	Overspeeding	1	-
27	Fri	1-Jun-07	Kampala-Jinja	Lwanyonyi	sideswipe	2	truck+trailer	-	-	15
28	Mon	9-Jul-07	Kampala-Jinja	Mabira Forest	Head-on	2	truck+truck	overtaking	4	-
29	Sat	14-Jul-07	Kampala-Jinja	Kigombya	Head-on	2	car+trailer	Overspeeding	1	2
30	Mon	1-Oct-07	Kampala-Jinja	Mukono	Loss of control	1	minibus	excessive loading	7	Several
31	Tue	6-Nov-07	Kampala-Jinja	Lugogo	Loss of control	1	car	Overspeeding	1	0
32	Fri	28-Mar-08	Jinja-Bugiri	Mailobiri	Loss of control	1	car	-	3	8
33	Sat	17-May-08	Kampala-Jinja	Kigunga	Head-on	2	trailer+truck	Overspeeding	5	-
34	Tue	10-Jul-08	Kampala-Jinja	Mukono	Head-on	2	car+car	-	1	-
35	Sat	18-Oct-08	Kampala-Jinja	Bulyantete	Loss of control	3	trailer+bus+car	-	27	60
36	Tue	28-Oct-08	Jinja-Iganga	Namasoga	Head-on	2	omnibus+car	Overtaking	5	-
37	Tue	28-Oct-08	Jinja-Iganga	CMS town council	Head-on	3	lorry+2cars	-	1	10
38	Thu	1-Jan-09	Kampala-Jinja	Wampeewo Roundabout	Loss of control	1	omnibus	-	0	3
39	Sat	20-Jun-09	Kampala-Jinja	Namukago-Lugazi	Head-on	2	Truck+omnibus	overtaking	5	-
40	Wed	17-Mar-10	Jinja-Iganga	Buwanga	Head-on	2	bus+omnibus	-	5	3
41	Tue	13-Apr-10	Kampala-Jinja	Jijnja	Loss of control	1	minibus	drunk driver	5	-
42	Thu	12-Aug-10	Kampala-Jinja	Buikwe	Head-on	3	omnibus + lorry + truck	reckless driving	10	7
43	Thu	9-Sep-10	Jinja-Iganga	Kakira	Head-on	2	trailer+trailer	reckless driving	3	Several

3.2 Speeding and Overtaking Blackspots

Thirty three (33) speeding and overtaking blackspots were identified during field inspections conducted with the help to traffic police along the highway (see Table 3). Twenty one (21)

blackspots are located between Bweyogerere and Jinja, six (6) between Jinja and Iganga, and six (6) between Iganga and Bugiri. Loss of control accidents and those resulting from excessive speeds include; Namagunga Junction, Kitega, Bulyantete, Rwankima, Near UNRA weighbridge after Magamaga, Nakalama, Butende Swamp, Busesa Swamp and Gogero swamp. Twenty three (23) of these blackspots involve head-on accidents resulting from inappropriate overtaking, and most occur in Bweyogerere – Jinja section. Deficiencies at specific locations are described in Table 3 and photo illustrations in Appendix I.

Blackspots meant for speed and overtaking enforcement this year were selected based on available space for parking of stopped vehicles, visibility, previous enforcement record and reported frequency of occurrence of accidents. If funds are available and traffic police has a mobile unit, both speed and appropriate overtaking be enforced at all the thirty three blackspots. It is recommended that Safe Way Right Way together with traffic police enforce speed and appropriate overtaking at the following high priority sections;

1) Rwenzori Factory Namanve,
2) Walusubi,
3) Kayanja,
4) Namagunga,
5) Kakira Sugar Factory,
6) Mabira Rwankima,
7) Kitega,
8) Bulyantete,
9) Nakalama,
10) Butende Swamp,
11) Busesa Swamp, and
12) Gogero Swamp.

Table 4: Speeding and Overtaking Blackspots identified with Traffic Police along Kampala-Malaba Highway

No	Police Station	Blackspot Name	Road Section	Alignment and Geometric Attributes	Cause (s) of Accident (Traffic Police and Visual Inspection)	Proposed Safety Intervention
1	Seeta Station	Ruwenzori Bottling Factory Access-Namanve	Kampala-Jinja	Crest curve from Namanve side as you approach Ruwenzori bottling, speed limit is 50 km /h and a no overtaking section. No overtaking signs exist on the road opposite the gate of Red pepper. Solid center-line marking for no overtaking section has worn out. There are also four access points in this section that is 619 meters long.	The section is marked as no overtaking zone for 619 meters in both travel directions. However, overtaking occurs in both travel directions and is completed near the Rwenzori factory access, where head-on collisions occur as a result of double overtaking involving more than one overtaken vehicle. Traffic Police have gazetted it a permanent overtaking and speeding control section during day time.	Restore centerline marking that has faded. Traffic police enforce overtaking prohibition and speeding.
2	Seeta/Mukono Stations	Kigunga / Ntawo Corner	Kampala-Jinja	Curved section / sharp bend (To the right as you move to Jinja from Kampala);, narrow road in corner; High speed section as vehicles from Jinja enter curve at very high speeds, tire marks for hard braking observed . The roadside is steep into the valley allowing no recovery after leaving the road.	Head-on collisions as vehicles from Jinja attempt to overtake more than two vehicles in a stream in a sharp bend and they are caught –up before completing the overtaking action. This section is even a no overtaking zone.	Speeding and overtaking enforcement by Traffic Police. Bush clearing inside the horizontal curve in the sag to increase visibility. Widen the horizontal curves.
3	Mukono Station	Ntawo Junction	Kampala-Jinja	Skewed and acute angle T-junction in horizontal curve and descending vertical curve. The junction is concealed to through traffic. In addition, there is a motor cycle stage.	Angle collision between vehicles accessing the main road with through traffic as well as motor cycle collision with through traffic.	Clear adjacent area to make the junction conspicuous to traffic on all approaches. Relocate motor cycle stage.

4	Mukono Station	Wantoni Mukono (Kirangira-Nkokonjeru Junction)	Kampala-Jinja	Junction with Kirangira and Nkokonjeru Roads. The two junctions are located at the beginning of a horizontal curve and crest in vertical alignment. In addition, on the side of Nkokonjeru Road, there are shops, pedestrian activity and parking of mini-buses crowding the road section for Mukono bound traffic.	Kirangira Junction is inside a horizontal curve (radius = 610 meters). There is limited sight distance for Jinja bound traffic. The junction is not visible from far enough and obstructed by crowding of signs. Continuity of the road is blurred by parked vehicles from Nkokonjeru. The effect is severe at night.	There is need for an auxiliary lane 150 meters for Mukono-bound traffic from Nkokonjeru Road, separated from the main highway by Median with guard rails. Pedestrian crossing be located upstream the junction. Sign posts should be cleared as well to create visibility; as creating a splitter island on Kirangira and Nkokonjeru Roads.
5	Mukono Station	Kigombya Junction Near diversion to Zimmwe Stone crushing site	Kampala-Jinja	Horizontal curve and a Y-junction in a steep vertical curve. There are scattered homes around the junction.	Steep vertical curve significantly reduces speed of heavily loaded trucks heading to Kampala. This results in overtaking maneuvers of passenger cars albeit with limited visibility. As a result, head-on collision occurs with Jinja-bound traffic descending the vertical curve.	Climbing lane in Kampala direction to accommodate slow trucks so as to limit overtaking and mitigate head-on accidents. In addition,, channelize and enhance visibility of the junction with appropriate signage.
6	Mukono Station	Global Paper	Kampala-Jinja	Double horizontal curves in a flat terrain, limited visibility between the curves.	Vehicles come out of either horizontal curves at very high speeds in both directions, attempt to overtake and complete the maneuver in the second horizontal curve, colliding head-on with vehicles in opposing direction. This occurs in front of the access to Global Paper Factory	At the time of inspection, a final asphalt surface had been placed. No marking and signage yet. This section should be a no overtaking zone by marking and signage as temporary measures. Future rehabilitation should consider widening the two curves to allow sufficient visibility.

7	Mukono Station	Walusubi after Namawojjolo	Kampala-Jinja	Combination of crest and horizontal curve reduces visibility to approach drivers in both directions after long tangents. This combination occurs for about 300 meters. Inside the curve is also an access road that is concealed to motorists.	Kampala bound traffic speed over the long tangent section before the curve and continue overtaking up to the midpoint of the curve, where they collide with traffic in opposing direction. The collision results due to limited sight distance.	This section should be marked as no overtaking zone, and horizontal curve widened enough to allow enough visibility. Future rehabilitation should consider grading the vertical curve to create enough sight distance. Install chevron signs to direct drivers on the direction of the highway.
8	Lugazi Station	Namagunga Junction	Kampala-Jinja	A T-junction in a horizontal curve with bus bays and two pedestrian crossings 50 meters from the junction centerline. The bus bay in Kampala direction is within the junction itself, and the zebra crossing away from it. Pedestrians do not use it. Posted speed limit 50 km/h.	Speeds in excess of the posted speed limit. Turning vehicles to Namagunga cause conflict with speeding vehicles on the highway resulting in vehicle – vehicle accidents. in addition, vehicle-pedestrian accidents are common due to crossings by pedestrians since it is a built – up area on both sides.	Short Term Measure: Police enforce 50 km/h speed limit. Sensitize area residents on safe crossing. Long term measure: Re-model the junction to include right turning bay for vehicles to Namagunga. Relocate the bus bay 50 meters from the junction. Protect lower side with guard rail.
9	Lugazi Station	Kitega (1)	Kampala-Jinja	Right horizontal curve for Kampala bound traffic after a long tangent section with sufficient visibility. Built-up road environment on both sides.	Loss of control accidents resulting from over speeding into the horizontal curves and ramming into adjacent houses.	This section has a speeding problem. Excessive speeds for the horizontal curves that result in loss of control. Police should enforce speeds.
10	Lugazi Station	Kitega (2)	Kampala-Jinja	Horizontal curve section with sufficient visibility encouraging speeding.	Vehicles from Lugazi lose control and crush into properties on the left side of the curve towards Kampala	Speed enforcement of 80 km/h although it would be necessary to reduce this speed limit to 50 km/h being a built up area.

11	Lugazi Station	Lugazi Corner	Kampala-Jinja	A horizontal curve to the left as you enters Lugazi from Kampala. There is a climbing for use by heavy and slow vehicles. Marking and signs for climbing lane are missing. There is limited visibility in the corner due a steep embankment inside the curve. This location is where there is Uganda Sports Press Association Monument for their colleagues who perished in the accident there.	Accidents in this section are mainly head-on involving Kampala bound vehicles from Lugazi overtaking others using the running lane of vehicles of opposing direction. It seems Kampala bound traffic does not know the middle lane is for Jinja bound traffic, and therefore should use one lane.	Restore climbing lane markings and signage at this location. Since the section is within Lugazi TC, future rehabilitation should separate climbing lane with raised median barrier to minimize overtaking conflict.
12	Lugazi Station	Lugazi Bridge	Kampala-Jinja	Narrow bridge without enough shoulder width for pedestrian walking parallel to the road on both sides.	Vehicle pedestrian collision involving pedestrians moving parallel the road from Lugazi Town. Pedestrians and motorcyclist share limited space resulting in collisions especially at night.	Widening the bridge is required to create walking provision for pedestrians on both sides of the road.
13	Lugazi Station	Near Kawolo Hospital	Kampala-Jinja	Abruptly ending shoulder for Kampala bound traffic coming from a climbing lane. The shoulder ends with pointed and steep kerbing onto Buikwe Road. There is also a pedestrian crossing at this location.	Shoulder ends abruptly and as such, when motorcyclists see it in the night, they avoid falling on to Buikwe Road and merge into the main traffic stream. The sudden merging results in motorcycle-vehicle accidents.	We can eliminate these accidents by improving the layout of Buikwe - Jinja Road Junction. The kerbing should be removed immediately and area graded to create continuity of the road. It was an error in the first place to leave such a kerbing hanging in the path of traffic as it is!

14	Lugazi Station	Bulyantete Bridge	Kampala-Jinja	Under pass (Bridge) for road going to sugar estate creating a crest along the high way, visibility obstructed by anti-hill with vegetation on the left side to Jinja near the parapet of the bridge; No warning sign for the underpass. Narrow bridge section to the underpass, and limited visibility on both sides of the bridge. Steep roadside environment does not allow recovery if the vehicle veers off the road.	Head-on collisions occur due to limited visibility going over the bridge and narrow bridge that barely accommodates vehicles in both directions. Accidents at this location occur between 08:00-11:00 and 16:00 to 22:00 hours; sometimes vehicles swerve in the ditch to avoid head-on collisions.	The treatment is to widen the bridge, raise the alignment by filling low sections approaching the bridge to create visibility. Install standard bridge warning signs. Immediate measure is to install warning signs for narrow bridge.
15	Lugazi Station	Bulyantete Straight Section	Kampala-Jinja	Straight section with steep vertical gradient and climbing lane in Jinja direction for 900 meters. Vehicles tend to over speed in both directions as well as overtaking. The section is built-up area on both sides.	Mainly vehicle –Pedestrian accidents occur at this section in the night while crossing the road.	This section is not a typical built-up area, most houses are off the road and therefore pedestrians randomly appear and cross the road. Proposal is sensitization on safe crossing, marking pedestrian crossing with signage and marking preceded with rumble strips.
16	Lugazi Station	Mabira – Rwankima	Kampala-Jinja	Combination of Horizontal and vertical curve, limited visibility due to vertical alignment, Very high speed segment where vehicles lose control.	Most accidents occur at night due to poor visibility due to reduced sight distance. Accidents occur every year according to police as a result of overtaking.	Enforce speed limit 80 km/h and overtaking restrictions.

17	Lugazi Station	Mabira – Near a picnic site located in Mabira	Kampala-Jinja	There is limited visibility due to short sight distance attributed to a short sag curve superimposed on a horizontal curve. The approach gradients are -5.30% and +6.20% separated by 200 metres. In addition, being a forest, tree growth inside this curve limits visibility further. This creates a likelihood of head-on accidents as it is unexpected compared to alignment features preceding it. Field observations indicate that several accidents have occurred at this location.	Head-on accidents resulting from speeding and inappropriate overtaking.	Raise the vertical alignment to create adequate visibility at both ends of the crest. In short term, traffic police enforce speed and overtaking.
18	Lugazi Station	Mabira-Buwala	Kampala-Jinja	Vertical and Horizontal Curve combination, narrow road, shoulders under-going repair, visibility impaired by the roadside bush and damaged shoulders.	Head-on collisions mostly occur at night due to limited visibility.	Similar measure as Near Picnic site is also proposed.
19	Lugazi Station	Mabira- Sanga	Kampala-Jinja	Climbing lane on direction to Kampala , Curved section; visibility obstructed by road side bushes and trees	Head-on accidents commonly occur. Vehicles towards Jinja mistakenly try to overtake in the running lane for traffic in the opposite direction as if the climbing lane is in their direction of travel.	Restore Climbing lane markings and signage at this location coupled with overtaking and speeding enforcement.
20	Lugazi Station	Kitigoma (Near GM Sugar factory)	Kampala-Jinja	Shoulders damaged , narrow road section, , curve combination , Swamp on both sides of the valley section (sag where the accidents occur)	Accidents occur in the valley section (sag) due to overtaking Maneuvers. Vehicles fail to complete the overtaking maneuvers and cause head –on collisions. Vehicles enter the valley section at high speed from both directions	Traffic police to enforce 80 km/h speed limit and inappropriate overtaking.

21	Lugazi Station	Nakibizi (near Hared Filling Station)	Kampala-Jinja	Busy Access exists on the left side after Hared towards Kampala from Jinja. Roadside parking by taxis reduces on clear visibility of motorists and motorcyclists merging into the high way.	Mainly Vehicle- accident Motor cycles are involved due to a conflict at the minor access; motor cyclists are killed by speeding vehicles on the high way as they merge into the high way due impaired visibility by the taxis that park on the road side very near the access.	Sensitize Motor cyclist on safe road crossing as well as relocating taxi stage to increase visibility of vehicles accessing the main highway from the access Road.
22	Jinja Station	Kakira Sugar Factory	Jinja-Iganga	This is a straight segment where the dual carriageway up to Jinja begins. It is a high speed section as can be seen from tire marks on both sides of the junction. It has motorcycle stage next to it and rumble strips.	Accidents at this location involve vehicles and motor cycles as well as loss of control due to speeding. In addition, the end of the dividing median abruptly appears to Jinja bound traffic. At high speed, most vehicles have run over it.	Traffic police enforce 80 km/h speed limit at this location. The end of the median needs to be redesigned according to the vehicle path in Jinja direction.
23	Jinja Station	Sag After Kakira Residential Estate	Jinja-Iganga	Section in a sag vertical curve with guard rails on both sides. However, the guard rails show scars of fatal accidents.	Head-on accidents resulting from speeding and inappropriate overtaking with no sufficient area to evade a possible collision in case of an error.	Traffic police enforce 80 km/h speed limit at this section and inappropriate overtaking although too narrow to stop vehicles safely.
24	Mayuge Station	Magamaga near Railway Bridge	Jinja-Iganga	Section in a sag vertical curve with guard rails on both sides. However, the guard rails show scars of fatal accidents.	Head-on accidents resulting from speeding and inappropriate overtaking with no sufficient area to evade a possible collision in case of an error.	Traffic police enforce 80 km/h speed limit at this section and inappropriate overtaking although too narrow to stop vehicles safely.

25	Mayuge Station	UNRA weigh bridge	Jinja-Iganga	Located on descending slope of a vertical curve from Iganga direction with a bus bay on the opposite side. The way bridge access requires heavy vehicles to make a right turn into the gate on nearly -6% vertical slope.	Accidents at this location are mainly loss of control by trucks turning into the weigh bridge gate.	UNRA should review the location as well as design of entry and exit at this weigh bridge. It is difficult for loaded trailers to safely make right angle turns on a steep slope. Many such accidents will continue to occur. Parallel access and exist to the main highway should be considered to minimize turning by trailers.
26	Iganga Station	Igenge next to a Mosque	Jinja-Iganga	Curve combination (horizontal and Sag curves). Damaged guard rails on both sides, reflectors stolen; no warning signs as you approach curves.	Mostly head-on collisions due to over speeding and attempting to overtake from both sides as you approach the curve.	Traffic police to enforce 80 km/h speed limit to curb unnecessary overtaking maneuvers.
27	Iganga Station	Access to Luuka District Local Government	Jinja-Iganga	Access located in long valley (sag vertical curve) with characteristic high speeds of vehicles in both directions and right turn Maneuvers from Iganga onto Luuka road.	Motorcycles from Iganga Town attempting to make right turn maneuvers to Luuka District accesses are crushed by speeding through traffic. Mainly vehicle –motorcycle accidents occur and all are fatal with very high frequency.	Long term measure: Redesign the junction to include a right turning bay for right turning vehicles and a median. This would involve widening the road section. Short term measure: Sensitize motorcyclist on safe crossing and provide them with reflector jackets.
28	Iganga Station	Nakalama	Iganga-Bugiri	Straight segment from 5% vertical gradient in a horizontal curve to a section with guard rails damaged by collisions.	Vehicle-vehicle accidents resulting from speeding and inappropriate overtaking.	Enforce speed limit 80 km/h and overtaking restrictions.
29	Iganga Station	Busobi	Iganga-Bugiri	Straight Segment about 2 km through a swamp area with clear visibility.	Loss of control accidents due to over speeding mainly involving trailers.	Traffic police enforce 80 km/h speed limit at this section.

30	Iganga Station	Butende Swampy section	Iganga-Bugiri	Straight segment 1270 meters long swamp with overtaking allowed from both directions. vehicles approach section at very high speed from both directions; Tire marks observed on the road surface	Head-on collisions mainly occur due to inappropriate overtaking maneuvers	80 km/h speed limit and overtaking enforcement by Traffic Police at this section.
31	Iganga Station	Butende – Busesa (Opposite Busesa Health Centre IV)	Iganga-Bugiri	Horizontal curve with continuous visibility and bus bay on one side. Vehicles move at very high speed and lose control near the center of the curve. There is an adjacent mass grave for accident victims (about 50 people) at this location.	Mainly vehicle – vehicle accidents due to inappropriate overtaking and single vehicle accidents due to excessive speed in a horizontal curve.	80 km/h speed limit and overtaking enforcement by Traffic Police at this section.
32	Iganga Station	Idudi – Buteba (Gogero Swamp)	Iganga-Bugiri	Straight segment with unlimited overtaking section 7.0 km from Idudi TC. The swamp section has guard rails covering a long stretch of the swamp; damages observed on guard rails, vehicles move at very high speed.	Mainly vehicle- vehicle accidents occur in this section due to high speed and improper overtaking maneuvers.	Traffic police to enforce 80 km/h speed limit to curb unnecessary overtaking maneuvers. Location of speed enforcement is problematic due to guard rails on both sides. It should be at either end of the section.
33	Tororo Station	Junction to Mbale	Malaba-Bugiri	Tight turning radius and narrow turning area (6.40 metres) increases delay for trucks negotiating the curves and likelihood of failed truck turning onto Mbale Road. This can be observed from tire marks on splitter islands. In addition, there is need to reducing conflict at service station accesses so as to minimize the likelihood of collisions and delays	Rear end and overturning accidents involving heavy vehicles occur at this junction.	There is need to fully channelize the junction to allocate the right-of-way through lane allocation and turning meeting the design vehicle standard. In addition, extend the median from splitter island by 85 meters to prevent traffic exiting the service station from turning right. (Covered under on-going project of Mbale - Tororo Rehabilitation)

Source: Uganda Police Force Field inspections: Seeta, Mukono, Lugazi, Jinja, Iganga, Bugiri and Tororo

3.3 Vehicle-Pedestrian Accident Blackspots

The second category of blackspots is characterized by vehicle-pedestrian accidents along the highway. These are mainly located in trading centers, scattered built-settlements and roadside markets. According to traffic police at several police stations along the highway, vehicle-pedestrian accidents mainly occur in the evening from 1800 to around 2300 hours in Trading Centers. While for roadside market areas, these accidents occur at any time of the day. Therefore two different treatment options are proposed for trading centers and roadside markets.

Roadside markets with high frequency of vehicle-pedestrian accidents were identified as; Namawojjolo, Najjembe, Lugalambo, Idudi and Bugiri Town. Vendors in these markets are at a high risk of accidents as they cross or even sell their merchandise on the carriageway. Moreover, vehicles double park on both sides of the highway, limiting visibility to through traffic. Vendors do not wear protective gear such as reflective jackets for easy identification during evening hours or when there is limited visibility due to fog or extreme rains. Lugalambo in particular is poorly located in horizontal curve, with no parking space for their customers. Literally, when a vehicle parks to buy their foods, the vendors are on the carriageway. This increases the likelihood of being knocked by through vehicles. As a long term measure, Lugalambo Roadside Market must be relocated 100 meters downstream or upstream the current location. Short term measures suggested to Safe Way Right Way to address safety risk of vendors at roadside markets are; (1) sensitization on safe highway crossing and (2) provision of marked reflector jackets to enhance visibility during evening hours. Additional measures in medium and long term at specific locations are described in Table 4 and illustrated in Appendix I.

Trading Centers such as Bugembe, Magamaga, Idudi, Bulanga, Bugiri and Naluwerere are characterized by parallel parking of trailers and fuel tanks in the evening. This limits through traffic visibility resulting in collision with pedestrians crossing the highway. This problem of parallel parking especially in the evenings requires concerted efforts between local leaders and traffic police with facilitation of Safe Way Right Way to gazette parking zones on either side that eliminates parallel parking. In addition, restoration of zebra crossings with new paint is required at all centers.

Other built-up areas with no traffic calming measures such as Kayanja, Namagunga, Bulyantete and Kitega require; (1) installation of guard rails on either side to limit distributed crossing by pedestrians to marked zebra crossings. In addition, rumble strips and humps are required to check through traffic speeds. In a mean time, traffic police should enforce 50 km/h speed limit at Kayanja, Namagunga, and Mbiko. At Bulyantete, a 50 km/h speed zone will have to be created first with placement of speed signs at both ends. The major challenge is that Bulyantete does not meet the criteria for a built-up area since most houses are 50 to 100 meters off the road.

Table 5: Vehicle - Pedestrian Blackspots identified with Traffic Police along Kampala-Malaba Highway

No	Police Station	Blackspot Name	Road Section	Alignment and Geometric Attributes	Cause (s) of Accident (Traffic Police and Visual Inspection)	Proposed Safety Intervention
1	Mukono Station	Mukono Junction to Kayunga	Kampala-Jinja	Mukono Junction. The median does not extend far enough allowing motorcyclists to make U-turns. No gazetted pedestrian crossing and protection in form of refugee island to cross the main highway. Turning on and off main highway from Kayunga occurs in a distance less than 30 meters increasing turning conflicts.	Making U-turn increase angle/sideswipe accidents at the junction for motorcyclists and passenger cars. Absence of gazetted pedestrian crossing, allows continuous and unprotected crossing of the main highway. Too many points of conflict with vehicles-motorcyclists in a very small area.	Extend the median to at least 150 meters past the petrol station on the right; fixed with guard rails, and marked pedestrian crossings. Median to restrain U-turns and median guard rails to restrain pedestrian crossing. Allow a long pocket for right turns on to Kayunga Road.
2	Mukono Station	Mbalala Junction	Kampala-Jinja	Level straight road segment, T-junction with heavy pedestrian and motorcycle crossing. The section is categorized as high speed.	Vehicles move at high speed, lose control and collide with motorcycles or pedestrians at the T-Junction.	Speed calming measures; rumble strips and humps and 50 km/h speed sign on both approaches to the Trading Center.
3	Mukono Station	Namawojjolo Roadside Market	Kampala-Jinja	Parking has been created for roadside trucks on the side of the market that seem adequate. However, there is uncontrolled crossing of pedestrians across the road section since the market is located on one side (Jinja direction). There is need to control pedestrian movement across two directions of flow. Vendors do not have reflector jackets to identify them in evenings.	Accidents reported at this location are mainly vehicle-pedestrians. These accidents are fatal and mainly intensity increases in the evening.	*Short Term measure*: Provide reflector jackets to the vendors, carryout sensitization of proper road crossing through market leaders. *Long term measure*: This section needs to be redesigned with a permanent median barrier to prevent pedestrians from crossing anywhere. Parking bay will have to be provided in Kampala bound direction.

4	Mukono Station	Namataba TC	Kampala-Jinja	Horizontal curve (Radius 630 meters) on a crest with up-gradient +5%. There are sight distance limitations and direction of the highway especially at night being a busy area with two access roads.	Vehicle pedestrian accidents mainly occur at this location coupled with angle vehicle-vehicle and motorcycle accidents.	Install chevron signs to show the direction of the highway at night in Jinja direction. In addition, install guard rails to limit pedestrian crossing along the section to gazetted pedestrian crossings.
5	Mukono Station	Kayanja TC	Kampala-Jinja	Kayanja TC located on a high speed section of double horizontal curves. The gradient is steep from for Kampala bound traffic. There is heavy pedestrian activity crossing between buildings on both sides of the road. It has a posted speed limit of 50 km/h.	Major accidents at this location involve vehicles and pedestrians crossing the road especially in the evening. It is a speed enforcement zone for traffic during day. Many pedestrians killed as they attempt to cross the road.	Speed limit enforcement by traffic police, marking zebra crossing and rumble strips as a speed calming measure. Use guardrails on both sides of the road section to control pedestrian crossing.
6	Lugazi Station	Namagunga Junction	Kampala-Jinja	A T-junction in a horizontal curve with bus bays and two pedestrian crossings 50 meters from the junction centerline. The bus bay in Kampala direction is within the junction itself, and the zebra crossing away from it. Pedestrians do not use it. Posted speed limit 50 km/h.	Speeds in excess of the posted speed limit. Turning vehicles to Namagunga cause conflict with speeding vehicles on the highway resulting in vehicle –vehicle accidents. in addition, vehicle-pedestrian accidents are common due to crossings by pedestrians since it is a built –up area on both sides.	*Short Term Measure*: Police enforce 50 km/h speed limit. Sensitize area residents on safe crossing. *Long term measure*: Re-model the junction to include right turning bay for vehicles to Namagunga. Relocate the bus bay 50 meters from the junction. Protect lower side with guard rail.
7	Lugazi Station	Kitega Corner	Kampala-Jinja	Built up environment on both sides of the road, most road signs vandalized and not yet replaced.	Mostly vehicle- pedestrian crushes due to over-speeding ; most accidents occur in the morning and at night, Posted speed is 50 km/h	Replace place and speed limit signs, and mark pedestrian crossings. Traffic police enforce 50 km/h speed limit.

8	Lugazi Station	Lugazi Town	Kampala-Jinja	Heavy pedestrian activity especially in the evening mixing with through traffic and local turning traffic to final destinations originating from Lugazi. There is a trailer and taxi park adjacent to the road in Jinja Direction. There are no visible marked pedestrian crossings within this section.	Pedestrian-vehicle collisions occurring in the evening when pedestrian activity increases considerably. In addition, heavy trailers park parallel to the road on both sides limiting sight distance for through traffic.	Mark three pedestrian crossings and restore rumble strips to calm speeds at this section. Sensitization and working with area leaders to limit roadside parking for trailers in the evening.
9	Lugazi Station	Najjembe (Road Side Market)	Kampala-Jinja	The market is located on a crest from Mabira Forest with heavy pedestrian activity (vendors). In addition, there are no parking bays on either side of the road to allow trucks to park and leave the highway for through traffic.	As such, many vehicle-pedestrian accidents occur as well as vehicle-vehicle accidents for Jinja bound traffic crossing the road to the Market area.	Long term Measure: There is need to construct two staggered parking bays for trailer/trucks by the roadsides to serve opposing traffic. The first bay adjacent to the market stall (Mukono bound traffic), 100 meters and the second on Jinja bound traffic staggered towards Mabira Forest side 50 meters, with a zebra crossing and median. The side slope on left lane (Jinja bound traffic) is steep and would require protection with guard rails. Short Term Measure: Advance warning signs for market area and speed zone (50 km/h), safety sensitization of vendors and marked reflector jackets.

10	Lugazi Station	Lugalambo (Sugar estate)	Kampala-Jinja	Lugalambo Junction in the Tea Estates. There is a junction opposite a road side market in a horizontal curve (Radius 620 meters)	The road side market increases the vehicle-pedestrian accidents. However, the access road is inside the horizontal curve, with limited visibility to on-coming traffic on the major highway. Vendors happily say they are knocked there every week.	Long term measure: This roadside market needs to be relocated upstream on a straight section with clear visibility. Short term Measure: Provide vendors with reflector jackets and sensitize them on safe crossing. Advance warning signs for market area to warn motorists of this area.
11	Lugazi Station	Mbiko TC	Kampala-Jinja	Climbing lane on the left side towards Kampala from Njeru Town. Partly curved from Nakibizi but tends to straight segment in the middle of town. Shoulders badly damaged along a big section of the road.	Accidents occur due to over speeding in both directions and inappropriate overtaking involving more than one vehicle in the running lane of opposing traffic causing head-on collisions. Vehicles from either direction cause accidents as they attempt to make right turns to the multiple accesses along Mbiko trading centre.	Traffic Police enforce 50 km/h speed limit, repaint zebra crossings and sensitize area residents on safe road crossing.
12	Lugazi Station	Njeru Market	Kampala-Jinja	An intersection (round about) The vehicles make both turn and maneuvers at this intersection point causing conflicts with the road to Kayunga	Vehicle mainly collide at the intersection; Due to road side parking by taxis at Njeru going towards Mbiko , many motor cyclists have been killed due to reduced visibility by roadside parking.	Relocate taxi parking away from the junction. Sensitize motor cyclist on safe crossing and provide them with reflector jackets. Junction to Kayunga needs to be redesigned to minimize right turning conflict off the main road.
13	Jinja Station	Bugembe TC	Jinja-Iganga	Bugembe TC is located on a vertical crest at least 2,000 meters, built on both sides with several humps and rumble strips. The median is about 2 meters wide. It is a 50 km/h speed zone.	Accidents in this trading center involve through vehicles and pedestrians crossing uniformly over the 2000 meter section.	*Short term Measure*: Repaint zebra crossings and sensitize pedestrians on safe highway crossing. *Medium Term Measure*: Install guard rails in the median to restrict distributed crossing of pedestrians with clear crossing points.

14	Mayuge Station	Magamaga TC	Jinja-Iganga	Busy town over a section of 1 km with heavy pedestrian presence in the evening. There are rumble strips and humps and a guard rail on one side. Trailers park on both sides of the road at night limiting visibility for through traffic.	Accidents at this town involve vehicle and pedestrians as well as motorcyclists due to limited visibility in the evening.	Repaint zebra crossings and sensitize motor cyclist on safe highway crossing.
15	Mayuge Station	Mayuge Junction TC	Jinja-Iganga	Major junction to Mayuge district headquarters located on a vertical crest with high pedestrian activity in the evening. The section is also about 400 meters. Zebra crossings have faded.	Accidents at this location involve vehicles and pedestrians as well as vehicle and motorcycles.	Repaint zebra crossings and sensitize motor cyclist on safe highway crossing.
16	Iganga Station	Bulanga TC	Jinja-Iganga	Short Section of 400 meters with high pedestrian activity especially in the evening and trailers parking on both sides of the road. The town is located in a horizontal curve and vertical crest with no clear direction of the road alignment at night.	Mainly Vehicle-pedestrian accidents occur in this trading center in the evening as trailers block visibility of pedestrians to through traffic.	50 km/h speed limit zone needs to be created in this section, with signs, marking and rumble strips. Section secured with guard rails to limit pedestrian crossing to gazetted points. Chevron signs to guide motorist on the direction of the alignment.
17	Iganga Station	Namasoga TC near storied house for the Rally Driver	Jinja-Iganga	Busy access to Namasoga Secondary School on the left side as you approach Namasoga corner from Iganga. Two bus bays on either side of the road.	Mainly speeding vehicles collide with Motorcycles from the access to Namasoga secondary school.	Sensitization of motorcyclist on safe crossing and merging to a main highway. Provide them with reflector jackets.

18	Iganga Station	Iganga Town (Town centre)	Iganga-Bugiri	The main Iganga Town is a stretch of about 2 km long with heavy pedestrian, motor and pedal cyclists presence that increase conflict with through vehicles especially in the evening. Particularly at an intersection next to a car park where merging and turning maneuvers result in fatal accidents.	Reported accidents involve through vehicles and motorcycles.	Sensitization of motorcycle operators in the town on safe crossing, provision of reflector jackets and painting faded zebra crossings.
19	Iganga Station	Iganga Hospital (Opposite main entrance)/ Nakavule	Iganga-Bugiri	Straight segment; motorists don't observe posted speed limit on a vertical gradient. Clear visibility but also heavy pedestrian presence accessing the hospital.	Vehicle –Pedestrian accidents in front of the gate as attendants to patients cross from the hospital to the nearby shops to buy supplies and drugs.	Mark a zebra crossing in front of the gate with rumble strips 50 meters from the gate in both directions. Sensitization fo hospital staff and security on safe crossing.
20	Iganga Station	Buseyi TC	Iganga-Bugiri	Straight segment in combination with a crest in the middle of the Trading centre; vehicles move through at very high speed in both directions. It is also a no overtaking section but motorists still do it anyway.	Vehicle- vehicle head-on accidents occur due to inappropriate overtaking maneuvers as well as pedestrian –vehicle accidents due to activities that require people to cross the road such as; shopping and fetching water from the hand pumps located on one side of the road.	50 km/h speed limit zone needs to be created in this section, with signs, marking and rumble strips. Section secured with guard rails to limit pedestrian crossing to gazetted points.
21	Iganga Station	Busesa TC	Iganga-Bugiri	Busy Crossing road to the nearby villages joins high way in the middle of the trading center. No provision for roadside parking and therefore parking vehicles obstruct visibility, vehicles move at very high speed through the TC from Bugiri side. It is 50 km/h speed zone.	Mainly vehicle- vehicle angle accidents for vehicles from access roads as well as pedestrian – vehicle accidents due to the high speed.	Traffic police needs to enforce 50 km/h speed limit in this area, re-paint faded zebra crossings and sensitize residents on safe crossing.

22	Iganga Station	Idudi TC	Iganga-Bugiri	Straight segment 1500 meters with ramble strips and road side markets. Road side parking for trailers on both sides reducing available roadway width and visibility for through traffic.	Vehicle – Pedestrian accidents are common in this town for vendors and other pedestrians due to reduced visibility for pedestrians crossing the road.	Sensitize vendors on safe crossing, provide reflector jackets, and work with area leaders and police to gazette and restrict parallel roadside parking of trailers.
23	Bugiri Station	Bugiri Town	Malaba-Bugiri	Long busy town of over 2,500 meters long. It is characterized by heavy pedestrian activity and trailer roadside parking in the evenings. There are rumble strips and humps.	Common accidents involve through vehicles and pedestrians in the evening resulting from limited visibility due to double roadside parking.	There is need to manage roadside parking of trailers to avoid parallel parking. This would have to be realized through sensitization and collaboration with area leaders.
24	Bugiri Station	Naluwerere Town	Malaba-Bugiri	Busy highway town characterized by roadside parking of trailers in the evenings. Zebra crossings, humps and rumble strips are new.	Vehicle-pedestrian accidents occur in this town in the evening due to double parking of trailers limiting visibility to through traffic.	Manage double roadside parking through sensitization of area local leaders.

Source: Uganda Police Force Field inspections: Seeta, Mukono, Lugazi, Jinja, Iganga, Bugiri and Tororo

3.4 School Zone Accident Blackspots

There are several schools along Kampala-Malaba highway located within 100 meters of the carriageway centreline with pupils crossing and/or moving parallel to the main highway. Between Bweyogerere and Iganga, most schools are located in trading centers with high pedestrian and motorcycle activity. The section between Iganga and Malaba, schools are located in relatively rural environment with scattered homesteads. Pupils in this section move longer distances from school parallel to the highway on both sides. This increases accident risk with motorcycles sharing shoulders in the morning and evening after school. Secondly, during inspection it was observed that most school accesses are poorly located in sag vertical curves and crests with limited visibility to through traffic. For instance, Seeta High School and Lugazi University are located in a high speed sag vertical curve. Solving access problems at these schools require major design improvements including channelizing the highway to create right turn lane and walkways a task that can only be handled appropriately by Uganda National Roads Authority.

Several schools are also located next to speeding and overtaking blackspots such as; Forest Hill College, Nuru Islamic School Bulanga, Ibunbaz Moslem Secondary School Iganga, Butende Islamic School and Idudi Moslem Primary School. These schools require sensitization that they are located at blackspots in addition to marking school zebra crossings and signage described in detail in Part IV. Table 5 gives a detailed description of blackspots adjacent to schools along the highway. Other schools were observed along the highway with no proper crossing points or signage conforming to The Highway Code (2004) specifications for school crossings. These include; comprehensive school Bweyogerere, Suzie Model School Bweyogerere, Seeta Primary School, All Saint Junior School Namataba, Mixed school Lugazi, Uganda Children's Hope Foundation and Integrated Primary School Bugembe, Ibaako Primary School after Busesa, St. Ann Vocational and Primary School, Nakawa Primary School Busowa and Ndifakulya Primary School. The above schools will require marking of zebra crossing, signage and education. Location of these schools is indicated on the blackspots location map in Section 3.5.

Safe Way Right Way required a selection of schools for sensitization, marking and signage of zebra crossings. Based on field observations, eight schools were selected considering; (1) traffic accident history, location close or at known black spot, (2) clustering in one area to reduce logistical and improvement costs, and (3) high risk based on field assessments where condition (1) and (2) do not apply. The following schools were therefore selected for possible intervention by Safe Way Right Way along the highway;

1) Church Missionary Society [CMS] Iganga consisting of Busoga University, Iganga Girls and Boys, Iganga Model School and Barclays School,
2) SDA Primary School Iganga and Tawfiq Islamic Primary School Buseyi,
3) All Saints Primary School Namataba,
4) Butende Islamic School,
5) St. Ann Vocational and Primary School Busowa,
6) Ndifakulya Primary School near Bugiri,
7) Lugazi Muslim Primary School, and
8) Idudi Moslem Primary School.

Table 6: School Zone Blackspots identified with Traffic Police along Kampala-Malaba Highway

No	Police Station	Blackspot Name	Road Section	Alignment and Geometric Attributes	Cause (s) of Accident (Traffic Police and Visual Inspection)	Proposed Safety Intervention
1	Seeta Station	Seeta High before Kigunga TC	Kampala-Jinja	Double horizontal curves on crests, limited sight distance, and speed limit is 50 km/h; Poorly located access to Seeta High School mid-way the two curves in a sag. Continuous solid line for no overtaking.	Head-on accidents arise when vehicles from Kigunga heading towards Seeta attempt to overtake and cause collision with those from also Seeta. In addition, turning conflicts at a high speed section for vehicles accessing Seeta High School result in accidents.	Overtaking and speed enforcement by Traffic Police. Relocation of Seeta High School Junction Toward Kigunga or Seeta and parallel to the main road.
2	Mukono Station	Forest Hill College near factory for steel and Junction to Nandagi	Kampala-Jinja	Crest curve with visibility obstructed	High speeding vehicles over the crest from Mukono collide with those from Kampala near the forest hill school; Pedestrians from the steel factors are also hit while crossing.	The junction is concealed to approaching drivers. Widen the junction and provide provision for staggered bus bays and a pedestrian crossing downstream the junction.
3	Lugazi Station	Lugazi University	Kampala-Jinja	Edge cracks observed, high speed segment; dangerous access to Lugazi University situated very close to a corner	Accidents occur at the access to Lugazi University. Rear end crashes as vehicles attempt to make right turn to Lugazi university.	The university access section will be redesigned to include midblock turning pocket to separate right turning vehicles to the university as well as place and access sign plates.
4	Iganga Station	Bulanga (near Nuru Islamic School)	Jinja-Iganga	Curve to the left as you move from Jinja side starting Near NURU Islamic School. Guard rails on both sides damaged by accidents and it is an overtaking section of length 960 meters.	Head-on accidents occur in this section. Vehicles from Iganga approach Namasoga corner at high speed and they attempt to overtake and fail to complete.	Traffic police to enforce 80 km/h speed limit and inappropriate overtaking.

5	Iganga Station	CMS Iganga and Busoga University Access.	Jinja-Iganga	Straight segment on a vertical curve with accesses to many institutions on both sides of the high way (Busoga University, Iganga girls, Iganga boys, Iganga model, Barclay). Lack of road side parking for taxis waiting for or unloading passengers (obstruct visibility) and excessive speeds. Rumble strips and faded zebra crossings.	Vehicle-vehicle accidents mainly occur due to limited visibility caused by road side parking and overtaking maneuvers as well as vehicle – pedestrian accidents due to many people crossing the road section since it's mainly a built up area.	Long term Measure: Design and bus bays for taxis and properly gazzetted crossing points secured with guard rails. Short term measure: Paint faded zebra crossings and sensitization on safe crossing of all schools in this area.
6	Iganga Station	Buseyi near IBUNBAZ Moslem Sec School	Iganga-Bugiri	Curved section; overtaking allowed in curved section according to markings observed because there is continuous visibility from both directions.	Mainly vehicle to vehicle head-on accidents due to inappropriate overtaking maneuvers that can be observed from damaged guard rails	Enforce speed limit 80 km/h and overtaking restrictions.
7	Iganga Station	Butende Islamic School	Iganga-Bugiri	Horizontal curve section with vehicles moving at high speed and adjacent to a primary school and trading center. No speed limit signs for this built-up area.	Mainly vehicle and school children accidents occur at this section due to over speeding in both sides.	Creation of 50 km/h speed limit zone including signs, marking and rumble strips; sensitization of the school on safe crossing and marking zebra crossings.
8	Iganga Station	Busesa (near Nkuutu Memorial School and Busesa Primary school)	Iganga-Bugiri	Straight segment; built-up area, very high speed section; many educational institutions by the roadside. No speed limit sign 50 km/h speed limit zone ends in the Trading center.	Accidents occurring in this section are vehicle-pedestrian due to over speeding and many crossing pedestrians who are pupils are often killed.	50 km/h speed limit zone needs to be extended to cover this area. Sensitization at schools on safe road crossing, provision of reflector jackets and marking at least two zebra crossings.
9	Iganga Station	Busesa Area (After Nkuutu Memorial SS as you approach Idudi Trading centre)	Iganga-Bugiri	This is a straight segment in a built-up area on both sides of the highway. There is no reduced speed limit required but even then, high speeds are observed.	Mainly loss of control due to high speed occur (single vehicle accidents) and vehicle –pedestrian accidents in the evening.	Speed enforcement of 80 km/h although it would be necessary to reduce this speed limit to 50 km/h being a built up area.

10	Iganga Station	IDUDI Moslem Primary school	Iganga-Bugiri	Horizontal curve section to the left as you move from **Idudi** towards Bugiri next to Idudi Moslem Primary school in the corner	Vehicle –pedestrian crashes due to high speed opposite a primary school.	Sensitization at the school on safe crossing; and marking of zebra crossing in front of the school access.

Source: Uganda Police Force Field inspections: Seeta, Mukono, Lugazi, Jinja, Iganga, Bugiri and Tororo

PART IV: INTERVENTION MEASURES

4.1 Categories of Intervention Measures

This section describes safety intervention measures SWRW can undertake to enhance road traffic safety along the highway. The proposed intervention measures have been preliminarily grouped according to accident categories discussed in Part III namely; speeding and overtaking, vehicle-pedestrian and school zones. These are described in respective sections.

4.2 Speed and Overtaking Enforcement

Thirty three (33) blackspots identified in Part III were as a result of accidents of over speeding and inappropriate overtaking. There is need for speed and appropriate overtaking enforcement. Presence of posted speed limits and overtaking zones is necessary for effective enforcement. Traffic police is expected to carry out 80 km/h speed limit enforcement at the following selected high speed and overtaking sections; Rwenzori Factory Namanve, Walusubi, Namagunga, Kakira Sugar Factory, Mabira Rwankima, Kitega, Bulyantete, Nakalama, Butende Swamp, Busesa Swamp, and Gogero Swamp. These sections have relatively good pavement conditions and visible passing zone marks save for Mabira and Kitega. Speed and appropriate overtaking will be carried out simultaneously at one section. However, it requires video evidence to show the driver the violation. Figure 10 shows the possible overtaking manuevers at an overtaking zone; A, B & C according to where they start and end with respect to the overtaking zone. Category A & C are not permitted in the Highway Code (2004) although category A is less severe since the driver may already have a clear visibility of the road ahead. Traffic Police will stop drivers in passing maneuver category C as they increase the likelihood of head-on accidents.

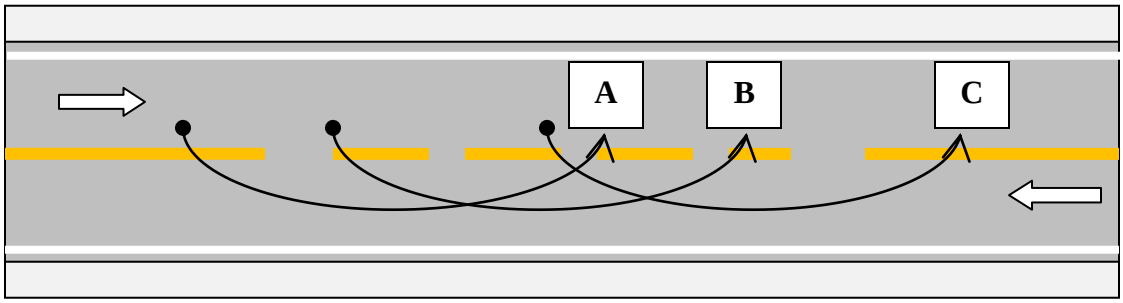


Figure 11: Classifying Overtaking Manuevers for Enforcement

4.3 Speeding and Overtaking Enforcement Framework

It is r proposed that the speed and overtaking enforcement should last at least fourteen days per section in the morning and evening. The morning periods should be 9-11 AM and evening period 4-6 PM. This should be preceded by a media campaign by Commissioner Traffic in Uganda Police Force about 80 km/h speed limit and overtaking enforcement. Safe Way Right Way will carry out before enforcement interviews of drivers at respective sections to assess whether they understood appropriate overtaking and 80 km/h speed limit. The framework below follows guidelines from The Handbook of Road safety Measures by Elvik, et al., (2009).

4.3.1 Problem and Objective

Exceeding the speed limit is a major traffic violation. Enforcement is intended to ensure compliance with the speed limit and to reduce the number and severity of accidents.

4.3.2 Description of Enforcement Options

There are three approaches that can be tapped while carrying out speed enforcement along the highway namely;

a) Stationary speed enforcement using radar/laser guns that measure the average speed between two observation points at stopping sites staffed by uniformed traffic police officers and marked police cars. More traffic police officers required to cover several sections.
b) Mobile highway patrol type also known as the "American Type" where one officer or two as often the case in Uganda patrol the highway in a car, have a speed gun, randomly stop at a speeding zone, measures speed of vehicles and apprehends those that violate the speed limit. One patrol vehicle dynamically moves between speeding sections.
c) Composite speed enforcement that includes both stationary and mobile methods. Resource intensive in terms of personnel and fuel.

4.3.3 Effect of Enforcement Options on Accidents

Elvik, et al., (2009) reported that stationary visible enforcement with radar/speed guns reduces the number of injury accidents by 17% with a 95% confidence interval between 2-31%. During a pilot study along Masaka Road, it was observed that permanent traffic police presence at a section significantly led to a reduction in excess speeds. Mobile enforcement alone has no significant effect on reduction of accidents based on reported studies (average reduction of 1% and 95% confidence interval between -5% and +4%). Composite speed enforcement shows a tendency of reducing the number of accidents but not statistically significant. However, due to limited traffic police personnel and long highway to be covered, it is proposed that the composite approach be adopted for speed and appropriate overtaking enforcement.

3.3.4 Cost-Benefit Analysis

An English study reported in Elvik, et al., (2009) showed that increase in enforcement by a factor of 6-8 reduced accidents by 25% and a benefit-cost 0.3 - 1.8. A similar study in America yielded a benefit-cost ratio 3.3 – 5.7. In Uganda, There has been an overall reduction in the number of accidents due to increased highway patrol and surveillance. However, it is not well documented to enable appropriate benefit-cost comparison.

3.3.5 Proposed Enforcement Goals

The following were proposed goals that shall form a basis for measuring effectiveness of the speeding and appropriate overtaking enforcement;

I: *Goal for Speed enforcement*: Reduce the observed 85^{th} percentile speed by 10-15 km/h during and after one month enforcement exercise. One week before enforcement, speeds will be

measure at respective sections, midway during enforcement and one week after enforcement. This will make it possible to measure benefits of enforcement or any changes that need to be made.

II: *Goal for Appropriate Overtaking enforcement:* Reduce the number of observed overtaking manuevers ending in a solid line upstream the passing zone by 50%. Before, during and after studies of overtaking manuevers in peak periods shall be carried out so as to measure the extent to which the goal was achieved.

4.3 Vehicle-Pedestrian Accident Reduction Measures

Proposed short term safety intervention measures to reduce vehicle-pedestrian accidents were broadly divided into; (1) busy towns and (2) roadside market. Long term measures were proposed for specific black spots and involved changes in geometric layout including installation of guard rails to limit pedestrian crossing in space, and building rumble strips and humps to control speeds. Short term measure to address safety concerns at roadside market of Namawojjolo, Najjembe, Lugalambo and Idudi, Safe Way Right Way will carry out sensitization to vendors on safe highway crossing and provision of marked reflector jackets. It was estimated that 30 reflector jackets will be distributed per section and a total of 120 at the four sections. At busy trading centers, SWRW together with Traffic Police will gazette parking slots for trailers to limit parallel parking. In addition, zebra crossings will be restored at Bugembe, Magamaga, Bulanga, Idudi, Kayanja, Namagunga, and Mbiko. Traffic Police will also be expected to carry out 50 km/h speed limit enforcement in the morning (9-11 AM) and evening (4-6 PM). Before and after speed studies will be carried out by SWRW to determine the impact of speed limit enforcement and sensitization campaigns. One of the indicators for safe crossing campaigns could be the proportion of pedestrians crossing the highway at the zebra crossing before and after.

Road user information campaigns including newspaper articles, radio commercials, brochures, and posters directed to a target group of people so as to cause a change in behavior have been shown to result in a reduction in accidents. For instance, Elvik, et al., (2009) reported that campaign and enforcement and education results in 14% reduction in accidents and a 95% confidence interval 5-22%.

4.4 School Zones Safety Measures

A three stage approach is proposed to enhance road traffic safety at School zones. As noted earlier, save for school between Iganga and Bweyogerere that are located in heavily built up areas those located between Iganga and Naluwerere are mainly in a rural setting. Pupils walk for a long distance parallel to the road which increases the likelihood of being knocked by motorcycles that they share shoulders for space. The first safety intervention is for SWRW to carry out road safety education in selected schools, advocate for Traffic Prefects, and provide reflector jackets and flags to aid crossing the road from the school compound. The quantity and need will depend on the individual schools.

Elvik, et al., (2009) reported past studies that analysed the effects of road safety education in schools for school children on accidents. Education on the right way to cross the road resulted in 11% reduction in injury accidents with children 5-9 years, and 20% reduction with children 9-12 years. Therefore sensitization at schools is hoped to yield greater benefits.

In addition, it is expected that SWRW will paint zebra crossing at shortest crossing points from the school gate. Specifications for the zebra crossing are given in Appendix II. Marking zebra crossing without warning for motorists is itself dangerous. Therefore it is proposed that advanced warning signs and one at the crossing are installed (see Appendix II for details). A fully functional pedestrian crossing at school zones should comprise of; (1) a marked pedestrian crossing on the carriageway, (2) advance warning signs in both travel directions, and (3) on-spot information signs including necessary supplementary plates, controlled entry and exit at school, and proper peak period schedule. The supplementary plates should indicate among others the distance to the crossing based on operating speeds on the highway, school peak periods, and an arrow pointing to the crossing point. The following sub sections provide a detailed description of both zebra crossing and signage specifications according to national and international standards.

4.4.1 Signage Specifications

General Specifications

The signs, plates and marking shall conform to Sections 5400 and 5500 of Ministry of Works, Housing and Communications (2005, Section 5400), *General Specifications for Road and Bridge Works* for both the manufacture and installation of signs, plates and markings. In particular, all signs shall be made of reflective material and colour codes described in The *Highway Code (2004),* and Traffic Signs Manual (2004). The Supplementary plates shall be made with a white reflective background, and black letters and arrow. The sign (I01) in the *Highway Code (2004)* shall be used to mark the position of the crossing, and W45 as an advance warning signs with supplementary plates as shown by the sketches in the Appendix II. The *Manual of Uniform Traffic Control Devices (MUTCD, 2009)* has appropriate school sign for marking the position of the crossing. This is lacking in both the Highway Code and Traffic Signs Manual in Uganda. The sign code I01 shall be used for pedestrian crossing, and supplemented with the plates to mark crossing positions on the carriageway.

Placement Distance of Signs

Placement of signs shall follow the traffic speed classes specified in the Traffic Signs Manual (2004); less or equal to 50 km/h and greater but up to 80 km/h. The signs should be visible within 50 and 150 metres for respective speed classes. The distance between the crossing and advance warning signs shall be 50 and 100 metres for respective speed classes. The distances were computed based on the perception reaction time of 2.50 seconds specified in 'A *policy on Geometric Design of Highways and Streets'* by American Association of State Highways and Transportation Officials [AASHTO] (2001). The 50 metre-spacing safely incorporates speeds up to 70 km/h, while 100 metre-spacing incorporates speeds of up to 120 km/h. This is to ensure that even high-speeding drivers can safely stop at the crossing.

Sign Sizes

The Traffic Signs Manual (2004) specifies the base length for primary signs based on the above speed classes as 720 mm (50 km/h) and 900 mm (80 km/h). The supplementary plates shall have the same width as the primary signs, the height of 300 mm adapted from MUTCD (2009) [600 x 300 mm], and the vertical spacing between plates and signs of 75 mm. Therefore supplementary plate dimensions of 600 x 300 mm were adopted for the project.

Supplementary Plate Text and Arrow Sizes

The sizes of text on supplementary plates shall conform to Section D.9.2 of the Traffic Signs Manual (2004). The height of capital letters shall be 70 mm for 50 km/h speed class and 50 mm for small letters. Whereas higher letter sizes are specified for speed class 80 km/h, the sizes of letters shall fit in the specified plate dimensions as shown in Appendix II. The Arrow dimensions are not specified in the manual, and therefore the engineer has specified the necessary dimensions to aid fabrication of the plate. The arrow will have a total length of 400 mm and with 100 mm, inclined 60^0 to the vertical as shown in Appendix II.

Lateral Clearance of Signs

The Traffic Signs Manual (2004) and MUTCD (2009) specify lateral placement of signs with respect to the shoulders and foot path as 600 mm and 300 mm as a minimum respectively. These shall be followed by the engineer during installation with appropriate judgement for visibility and safety requirements to immediate environment.

Mounting Height

The Traffic Signs Manual (2004) specifies the mounting heights of signs as a minimum of 1800 mm from the highest point of the carriageway, and 2100 mm from the highest point of a walkway. For this project, the mounting height of the base level of the primary sign shall be 2100 mm and minimum height of the lowest supplementary plate at 1350 mm (see drawing in the Appendix II).

4.4.2 Zebra Crossing Markings

The Departments of Transport and Regional Development [Northern Ireland]'s Manual on Traffic Signs (2003) and specifically Chapter 5 on Road markings specifies the dimensions and materials for pedestrian crossing markings. The markings shall be made of reflective black and white stripes. However, only white markings shall be applied. The minimum length of markings parallel to the travelled direction of the carriageway shall be 2400 mm and width of stripe 500 mm. These minimum specifications shall be adopted for all markings in the project.

FINDINGS AND RECOMMENDATIONS

Kampala-Malaba highway is part of the Northern corridor linking the coastal port of Mombasa in Kenya, Kampala, Uganda, Rwanda, Burundi, Democratic Republic of Congo and to a less extent South Sudan. It is the main import and export route by land from the East coastline at Mombasa, and thus very critical to economic development of Uganda. The terrain is generally flat from Malaba to Iganga and thereafter rolling up to Kampala. There are many long straight and level portions along Iganga-Malaba section than Iganga-Kampala. The maximum design speed for level and rolling terrain are 110 and 100 km/h respectively. The lane and shoulder widths are 3.50 and 2.00 meters respectively.

There are several 50 km/h speed zones in-built-up areas along the highway namely; Tororo, Naluwere, Busia, Idudi, Busesa, Nakalama, Iganga Town, Church Missionary Society [CMS] Iganga, Bulanga, Mayuge Junction, Magamaga, Bugembe, Njeru, Mbiko, Lugazi, Namawojjolo, Mbalala, Mukono, Seeta, Namanve and Bweyogerere. In most of these towns, speed signs have been removed and pedestrian crossings faded under traffic action. The rest of the highway motorists are allowed to move at 80 km/h. However, due to changing land use, several scattered settlements and roadside markets exist along this highway that are not marked and lack calming measures such as rumble strips and humps. These areas have a high risk of vehicle-pedestrian collisions and include Namataba, Kayanja, Namagunga, Kitigoma, Lugalambo, and Kitega.

There is a gradual reduction in elevation from 1144 m around Tororo to 1154 m at Iganga, rising again to a peak of 1254 m at Nakibizi near Jinja Town. The elevations then drop between Lugazi and Mukono from 1216 m to 1201 m, before rising again up to Bweyogerere. The maximum, average and minimum vertical elevations are 1074 m, 1150 m and 1254 m respectively based on GPS route data. The implications of this fall and rise in elevations is on the expected speeding characteristics of vehicles, which has a bearing on the type of accidents that occur. Indeed as confirmed from reported accident data, the section between Tororo and Iganga is a high speed zone as well as that between Lugazi and Mukono. There is significant speed reduction due to rise in elevation between Iganga and Lugazi implying a high risk of overtaking maneuvers resulting in mostly likely head-on accidents.

Available data for Mukono-Owen Falls Dam Section of the highway which is 54.20 km shows that there are 43 horizontal curves with radii ranging between 250 and 5680 metres. Only one horizontal curve has radius 495 meters below the specification for flat terrain but above threshold for rolling terrain (415 meters). Twenty four (24) horizontal curves have radii at most 700 meters. Therefore driving along Jinja-Mukono section requires full attention of the driver due to high likelihood of encountering many and shorter radii horizontal curves. These curves force the driver to adjust their approach speeds (decelerate) and accelerate after exiting the curve. Failure to adhere to these geometric constraints could result in loss of control or roll of accidents.

Traffic data was collected for two hours at four sections which were also blackspots namely; Busesa, Nakalama, Namasoga and Bulanga. Volume data extracted from videos in the two hours was grouped into vehicle categories as follows; saloon cars, taxis, 4 wheel drives [4WD] (including Prados, and pick-ups), trucks, buses, coasters and trailers (goods and fuel tanks) in respective direction of travel. The two hour directional volume data shows that the predominant vehicle category amongst passenger cars is taxis, and trailers in heavy vehicles. Traffic volume increases as you move between from Iganga to Jinja and beyond. Drivers in the section Iganga-Bugiri-Malaba have freedom to choose their speeds, and therefore a high likelihood of over speeding that may result in loss of control accidents. The relatively high volumes in the sections; Iganga-Jinja and Jinja-Kampala means drivers have less freedom to choose their own speeds and as such long queues behind slow vehicles develop. This situation increases the desire to overtake, which in turn increase the likelihood of head-on accidents.

The average speed of passenger cars is close to the legal speed limit of 80 km/h in rural sections although the maximum recorded speeds as significantly greater than the speed limit. The average speeds of heavy vehicles and motor cycles are lower than those passenger cars indicating variability in speeding environment by vehicle mix along the highway. This variability increases the desire to overtake as faster vehicles catch-up with slower vehicles. Secondly, speed data shows that 25% of all passenger cars move with speeds over and above 80 km/h and this difference is between 11-23 km/h in two travel directions and four stations. There is clearly a speeding problem especially of passenger cars that requires traffic police speed enforcement.

Head-on and loss of accident data archived from New Vision and daily Monitor Newspapers in the period 2005 - 2010 inclusive were for 31 highways in Uganda. Highways with high traffic volumes also have the highest total accidents; Kampala-Jinja, Kampala - Masaka, Kampala - Gulu, Masaka - Mbarara, and Jinja - Iganga. On aggregate, Kampala-Jinja-Iganga-Bugiri section had a total of 41 head-on and loss of control accidents. Head-on accidents reported were 26 accidents and 15 were loss of control accidents with the highest proportion reported along Kampala-Jinja section. Frequently reported blackspots along this highway include; Kitigoma, Namawojjolo, Kitega, Sanga-Mabira, Najjembe, Bulyantete, Mukono, Namagunga, Mabira Forest, Kigombya, Church Missionary Society [CMS] Iganga and Kakira.

Reported causes of accidents along the highway were over speeding, improper overtaking; tire burst and reckless driving. Vehicle categories involved in loss of control accidents were mainly taxis, buses and passenger cars. Head-on accidents involved either a taxi, bus, passenger car and a trailer or more than one trailer. This observation is consistent with traffic and speeding characteristics with respect to speeding and overtaking.

Field inspections together with traffic police officers identified 67 blackspots in the section between Bweyogerere and Naluwere after Bugiri. These are known accidents spots along this highway according to traffic police with high annual frequency of accident occurrence. The blackspots were broadly grouped into three broad categories namely; speeding and overtaking (33 No.), Vehicle-Pedestrians in towns and trading centers (24 No) and Blackspots at school zones (10 No.).

Blackspots meant for speed and overtaking enforcement this year were selected based on available space for parking of stopped vehicles, visibility, previous enforcement record and reported frequency of occurrence of accidents. If funds are available and traffic police has a mobile unit, both speed and appropriate overtaking be enforced at all the thirty three blackspots. It is recommended that Safe Way Right Way together with traffic police enforce speed and appropriate overtaking at the following high priority sections; Rwenzori Factory Namanve, Walusubi, Namagunga, Kakira Sugar Factory, Mabira Rwankima, Kitega, Bulyantete, Nakalama, Butende Swamp, Busesa Swamp, and Gogero Swamp.

Vehicle Pedestrian accidents were broadly divided into; (1) busy towns and (2) roadside Market. Long term measures were proposed for specific black spots and involved changes in geometric layout including installation of guard rails to limit pedestrian crossing in space, and building rumble strips and humps to control speeds. Short term measure to address safety concerns at roadside market of Namawojjolo, Najjembe, Lugalambo and Idudi. Safe Way Right Way will carry out sensitization to vendors on safe highway crossing and provision of marked reflector jackets.

Schools between Iganga and Bweyogerere that are located in heavily built up areas than those located between Iganga and Naluwerere that are mainly in a rural setting. Pupils walk for a long distance parallel to the road which increases the likelihood of being knocked by motorcycles that they share shoulders for space. The first safety intervention is for Safe Way Right Way to carry out road safety education in selected schools, train Traffic Guides, and provide reflector jackets and flags to aid crossing the road from the school compound. In addition, paint zebra crossing from the school gate. Install advance warning signs in both directions of travel and one at each crossing point. Selected schools include; (1) Church Missionary Society [CMS] Iganga consisting of Busoga University, Iganga Girls and Boys, Iganga Model School and Barclays School, (2) SDA Primary School Iganga and Tawfiq Islamic Primary School Buseyi, (3) All Saints Primary School Namataba, (4) Butende Islamic School, (5) St. Ann Vocational and Primary School Busowa, (6) Ndifakulya Primary School near Bugiri, (7) Lugazi Muslim Primary School, and (8) Idudi Moslem Primary School.

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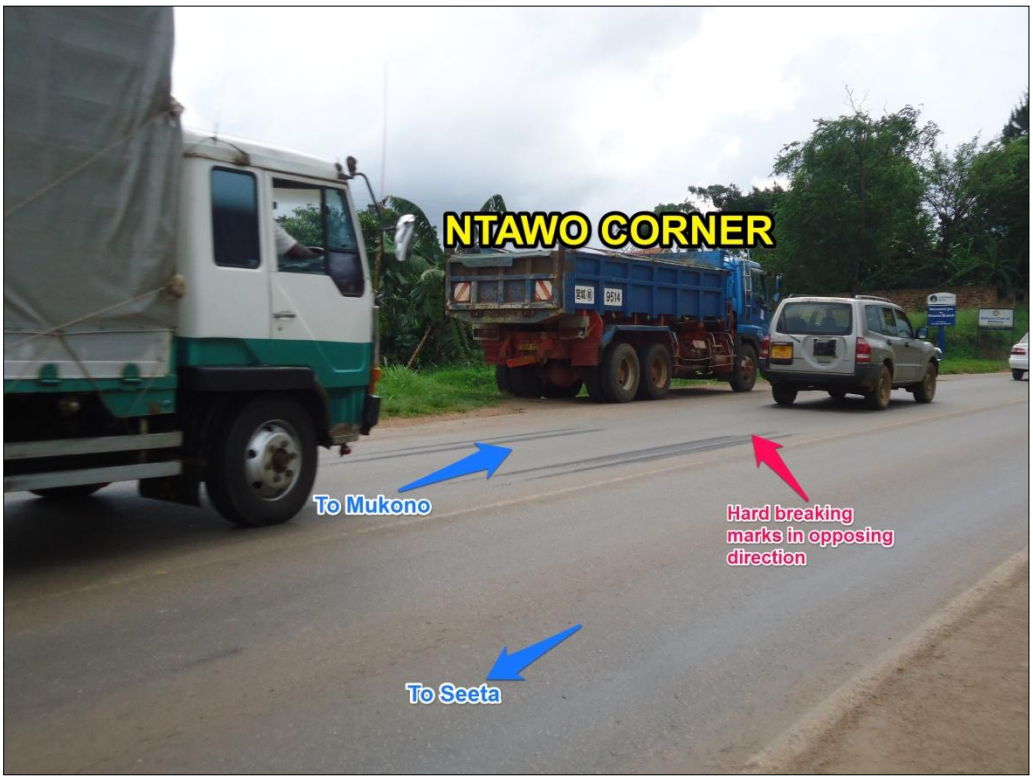
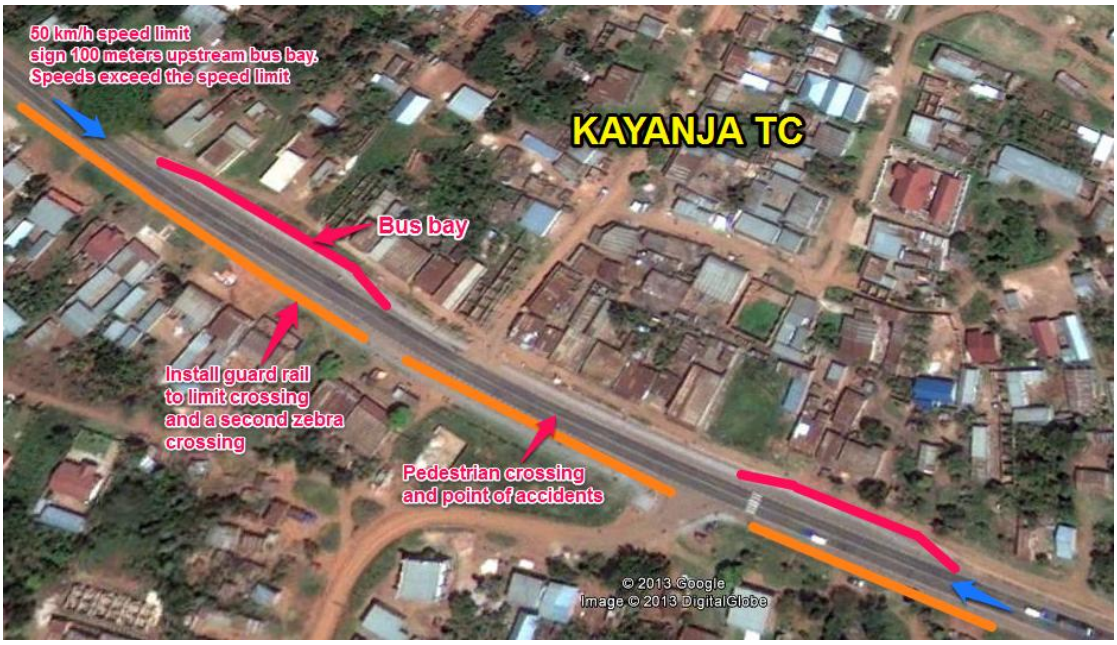
APPENDIX I: PHOTO PLATES SHOWING SAFETY CONCERNS AT SOME BLACKSPOTS




WALUSUBI
Point of head-on accidents
on the vertical crest.
Overatking in Kampala
direction
A 109
Kampala-Jinja Rd
Jinja bound traffic


GLOBAL PAPER FACTORY
Point of most head-on collsions
due to overtaking in a curve
To Lugazi
To Mukono

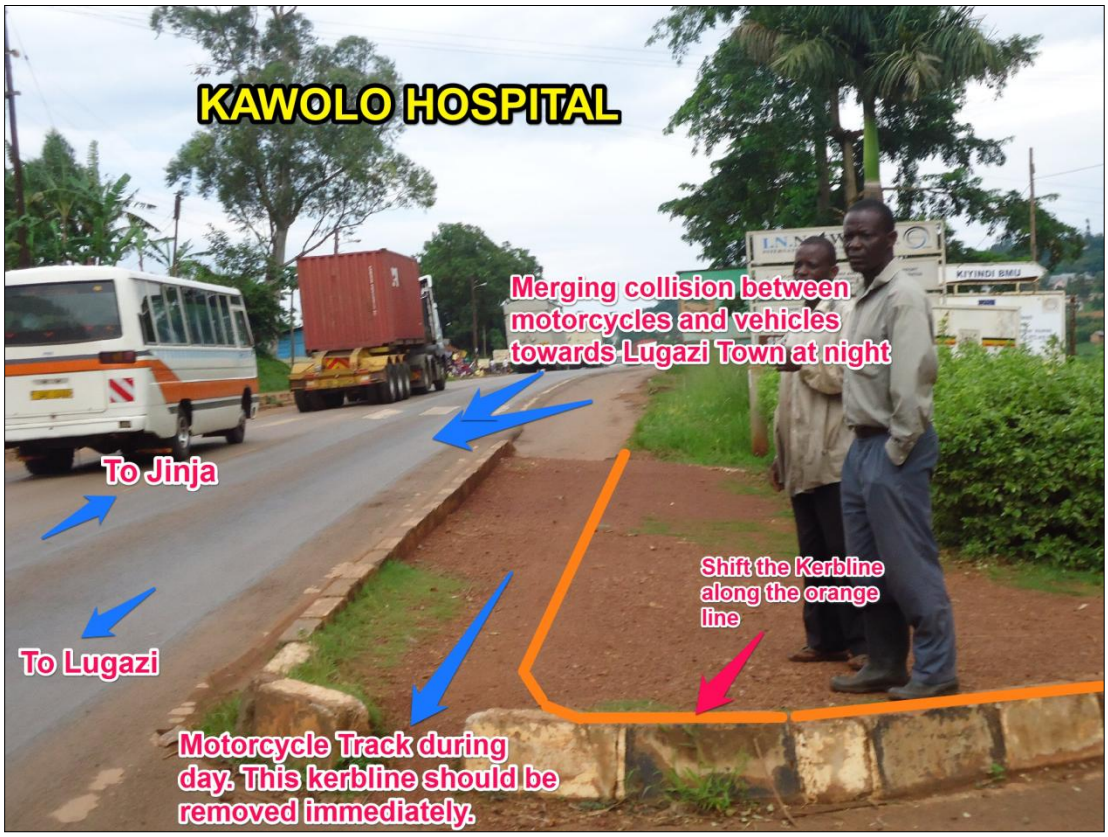

Parallel Parking on both sides
Limits visibility to through
traffic and vendors
Market stalls
MAERSK
To Mukono
To Lugazi
Vendors in the Road
without reflective jackets
Parking Bay
NAMAWOJJOLO MARKET


50 km/h speed limit
sign 100 meters upstream bus bay.
Speeds exceed the speed limit
KAYANJA TC
Bus bay
Install guard rail
to limit crossing
and a second zebra
crossing
Pedestrian crossing
and point of accidents
© 2013 Google
Image © 2013 DigitalGlobe

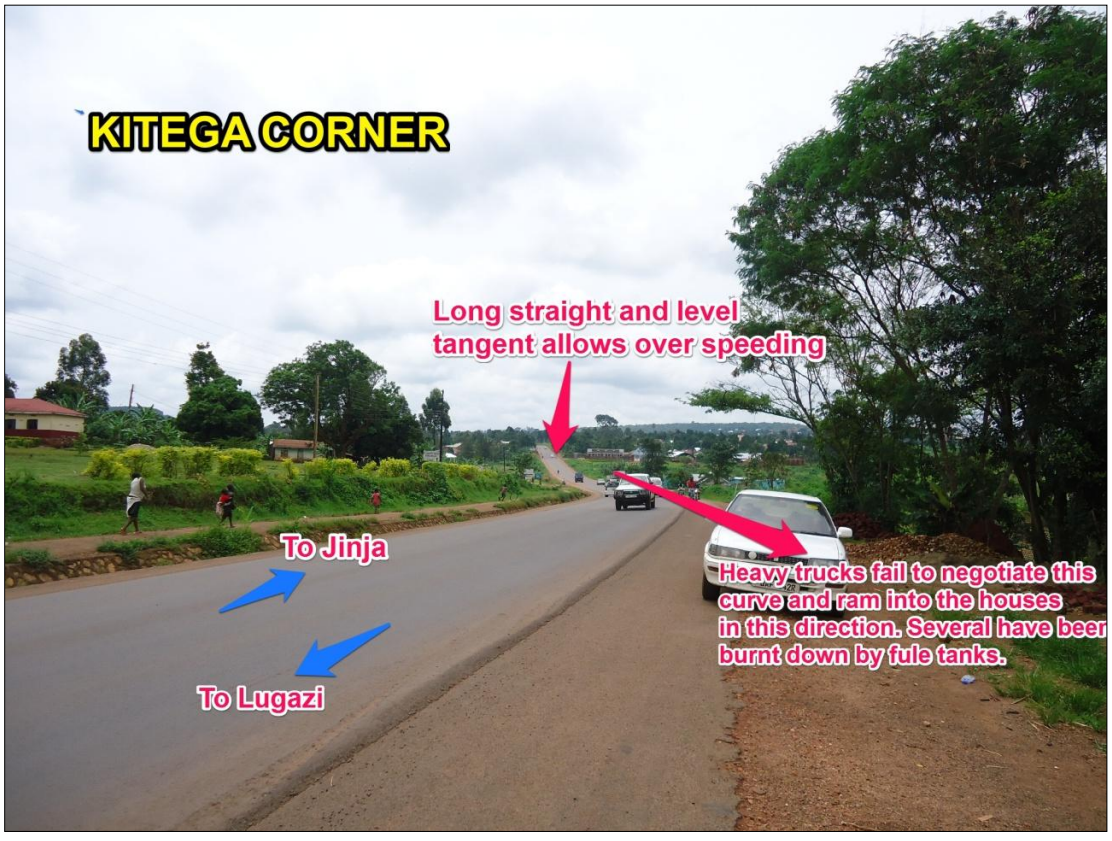

NAMAGUNGA JUNCTION
Zebra crossing far away from the busbay and junction. Rarely used by pedestrians
No pedestrian walkway but open storm water drain
A 109
Kampala-Jinja Rd
Bus bay directly opposite the junction blocks its vissibility. Should start at the zebra crossing. Area protected with guard rail


LUGAZI TOWN
Roadside Taxi Park
Road section where pedestrians are knocked by vehicles in the evening
Narrow bridge without space for pedstrians. Accidents often occur here between pedstrians and vehicles
Beginning of climbing lane
Islamic Primary Sch. close to the road
USPA monument
Overtaking accident location Vehicles going to Kampala overtake in middle lane for Jinja Traffic

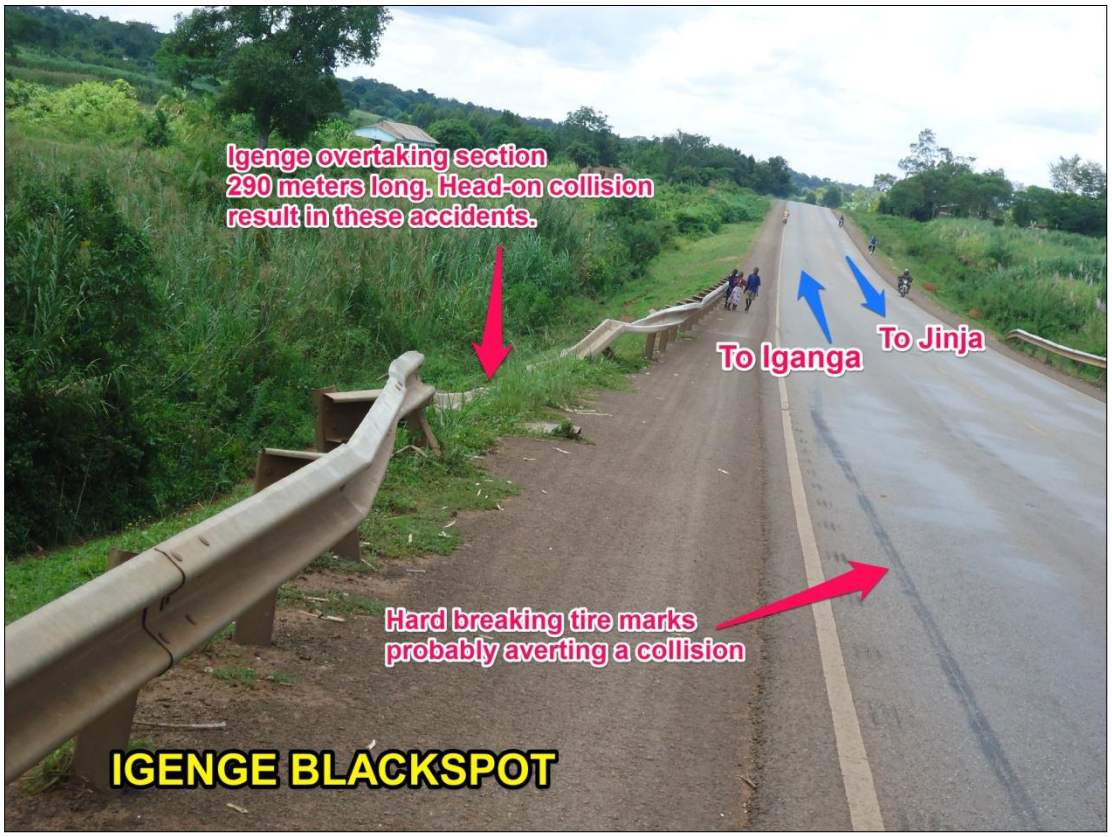

LUGAZI TOWN CURVE
Sharp curve on a vertical crest with a climbing lane approaching Lugazi Town (Poor visibility from Lugazi. Overtaking accidents occur here
bpc
NEPTUNE
PAINTS
To Lugazi
To Mukono

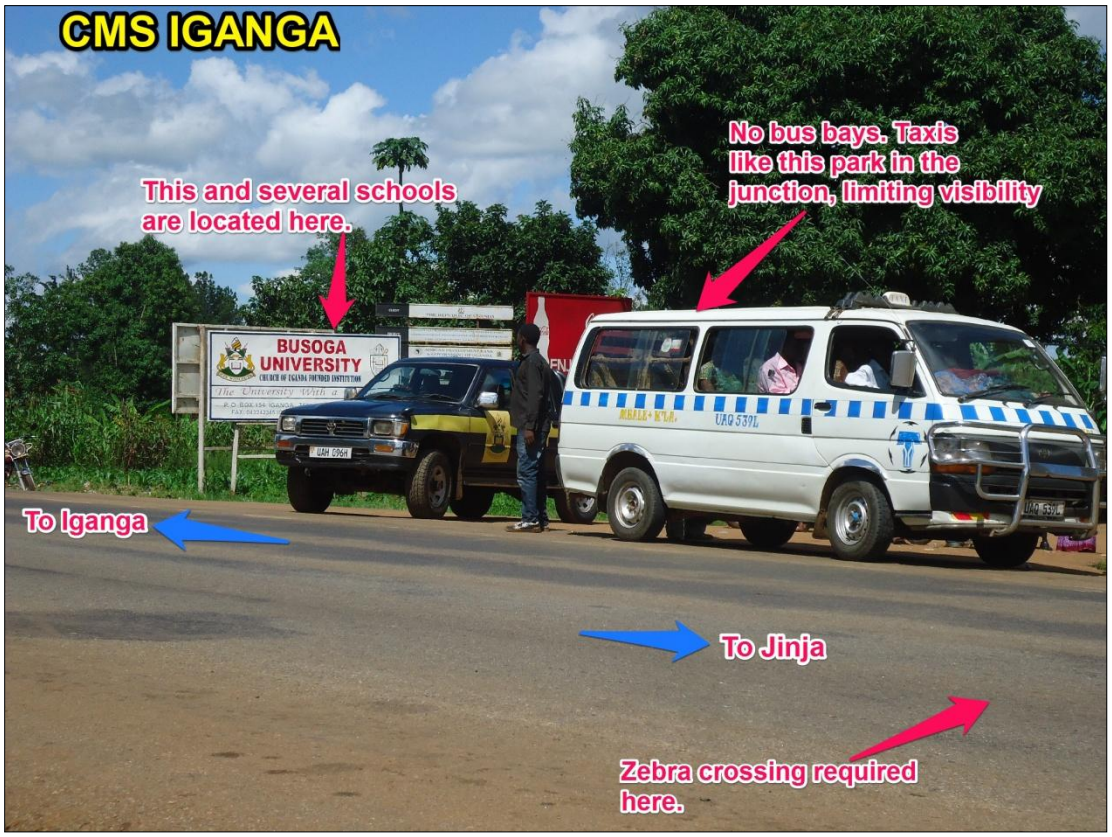

KAWOLO HOSPITAL
Merging collision between motorcycles and vehicles towards Lugazi Town at night
To Jinja
To Lugazi
Shift the Kerbline along the orange line
Motorcycle Track during day. This kerbline should be removed immediately.


NAJJEMBE MARKET
Accident scars
Vendors scattered in the road at Najjembe market
Towards Jinja
Towards kampala

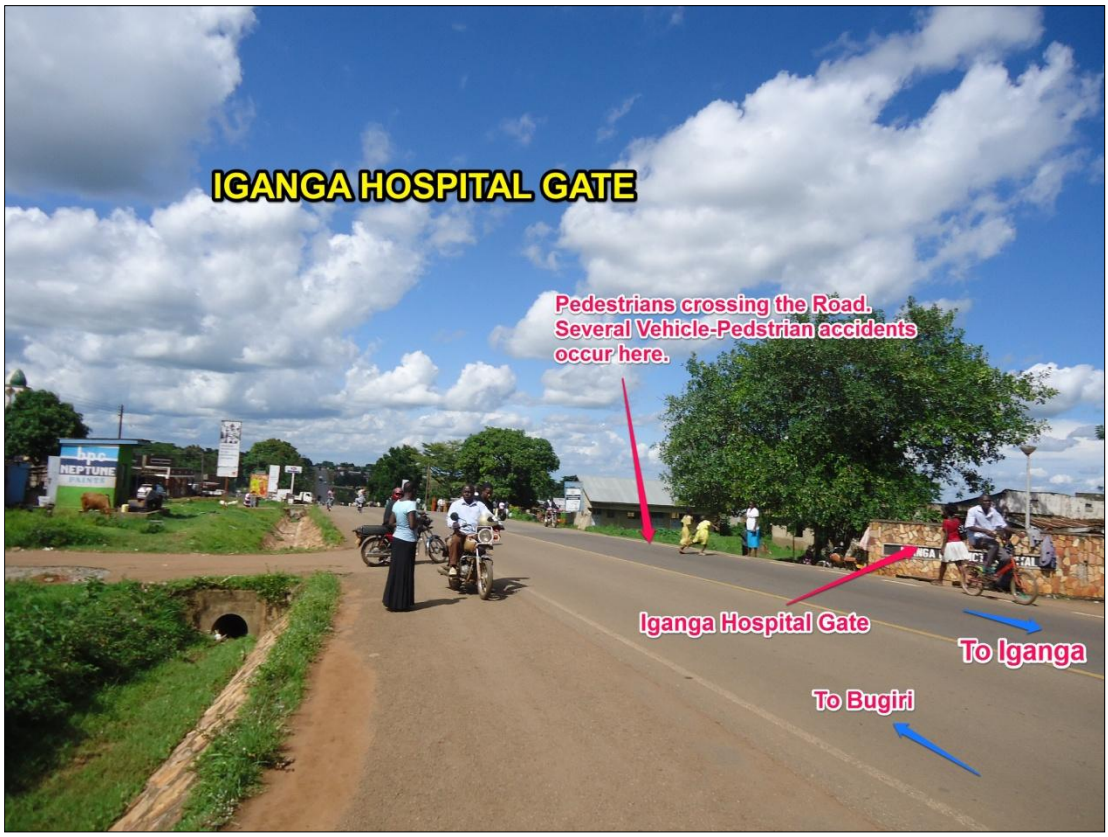

KITEGA CORNER
Long straight and level tangent allows over speeding
To Jinja
To Lugazi
Heavy trucks fail to negotiate this curve and ram into the houses in this direction. Several have been burnt down by fule tanks.


MBIKO
Speeding and overtaking zone
in a heavy pedstrian zone
Pedestrians killed
along this stretch
To Jinja
Two lanes to Lugazi
DANGER PETROLEUM
TRANST GOODS


Igenge overtaking section
290 meters long. Head-on collision
result in these accidents.
To Iganga
To Jinja
Hard breaking tire marks
probably averting a collision
IGENGE BLACKSPOT

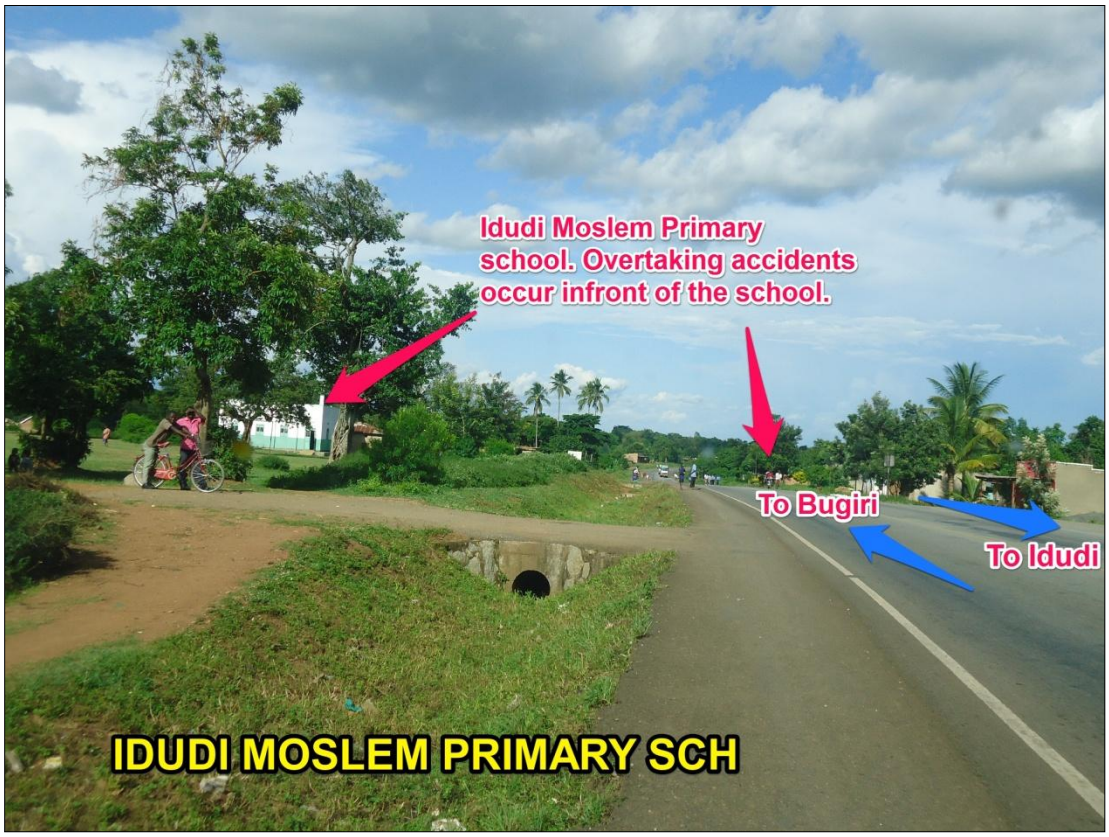

CMS IGANGA
This and several schools are located here.
No bus bays. Taxis like this park in the junction, limiting visibility
BUSOGA UNIVERSITY
To Iganga
To Jinja
Zebra crossing required here.

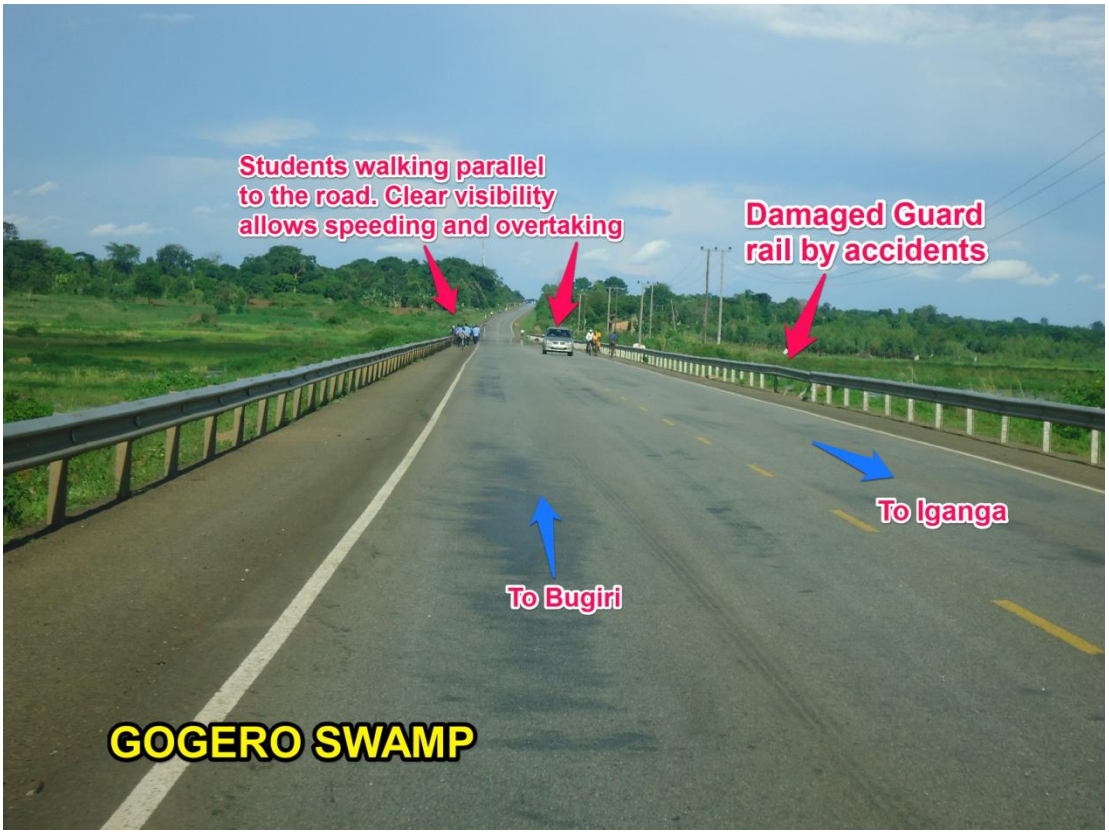

LUUKA LOCAL GOVERMENT JUNCTION
Junction located in a high speed section and not visible to through traffic.
Turning from Luuka. Motorcycles knocked here everyday turning right from Iganga.
To Iganga
To Jinja
Guard rails damaged by accidents


IGANGA HOSPITAL GATE
Pedestrians crossing the Road.
Several Vehicle-Pedstrian accidents
occur here.
Iganga Hospital Gate
To Iganga
To Bugiri


BUSEYI IBUNBAZ MOSLEM SS
Vehicles colided here due to inappropriate
overtaking allowed in a curve.
Observe tire marks on the pavement
due to hard breaking
Buseyi Ibunbaz Moslem Secondary
School
To Iganga
To Bugiri

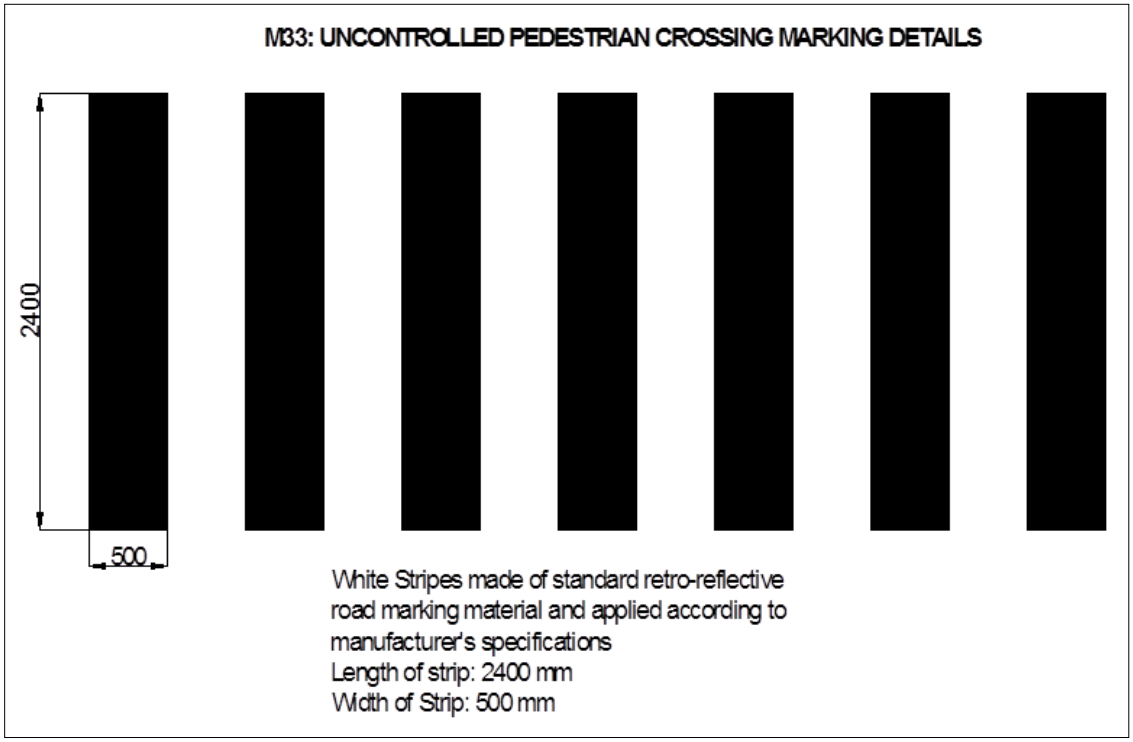

IDUDI TC
Roadside Market and
Trailer parking at Idudi.
Vehicle-pedstrian accidents
are common.
To Bugiri
To Iganga

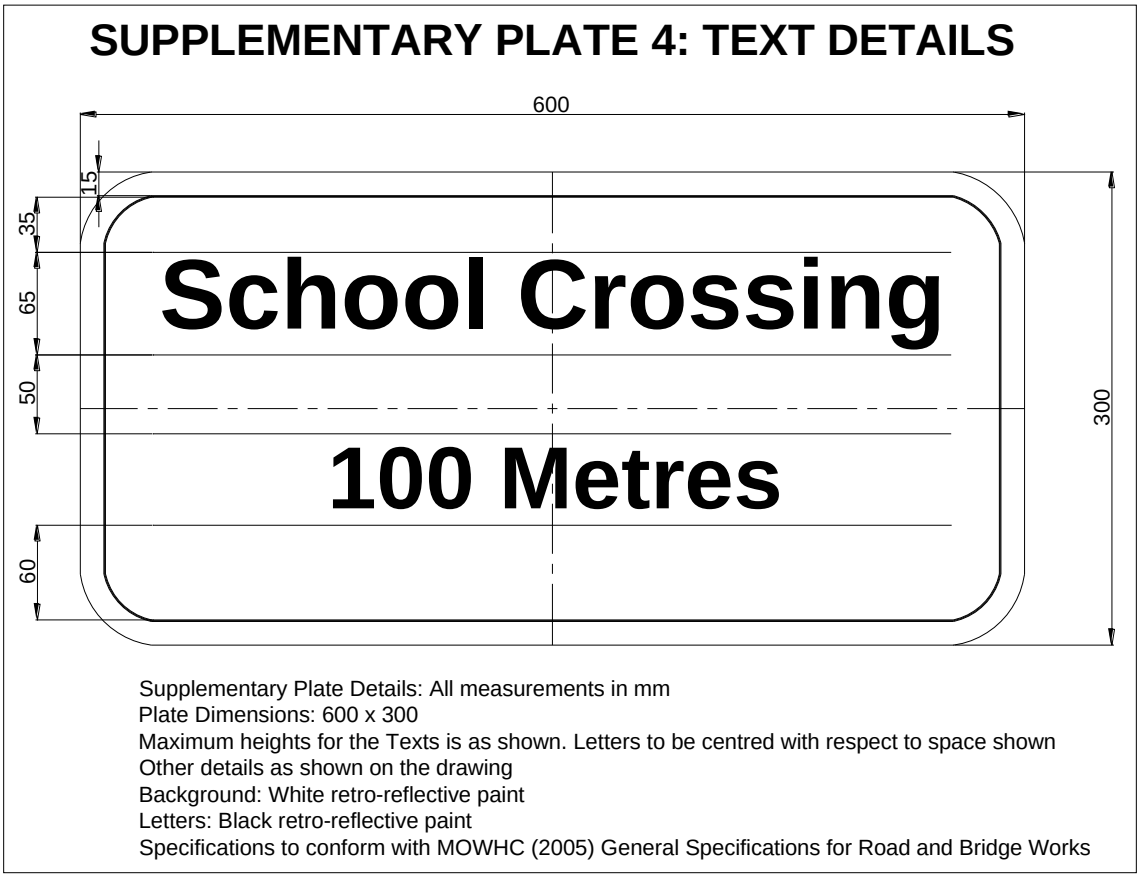

Idudi Moslem Primary
school. Overtaking accidents
occur infront of the school.
To Bugiri
To Idudi
IDUDI MOSLEM PRIMARY SCH


Students walking parallel
to the road. Clear visibility
allows speeding and overtaking
Damaged Guard
rail by accidents
To Iganga
To Bugiri
GOGERO SWAMP

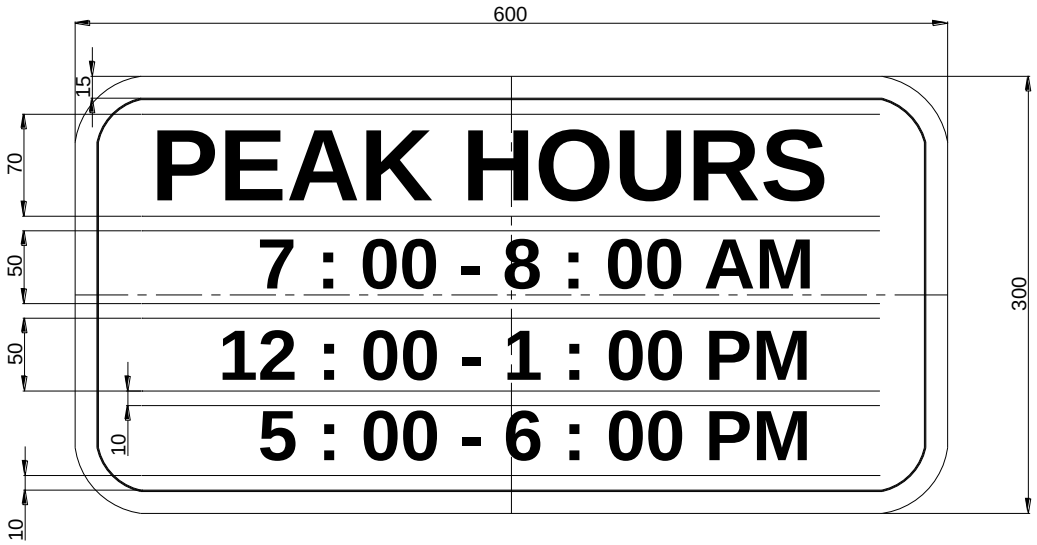

NDIFAKULYA PS
Pupils move parallel to a high speed highway after school.
To Iganga
To Bugiri

APPENDIX II: SCHOOL CROSSING MARKING AND SIGNAGE DETAILS



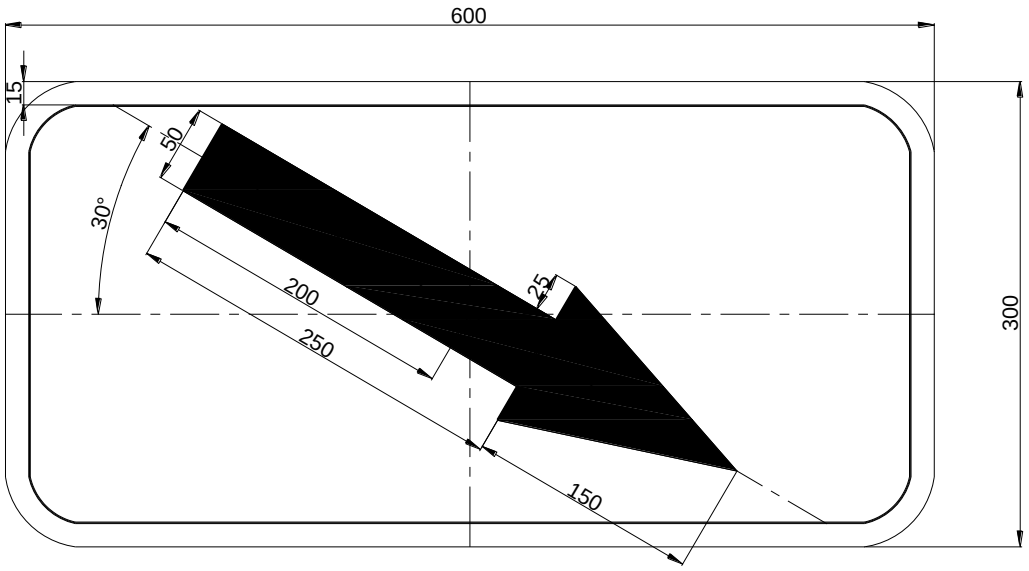


SUPPLEMENTARY PLATE 2: TEXT DETAILS

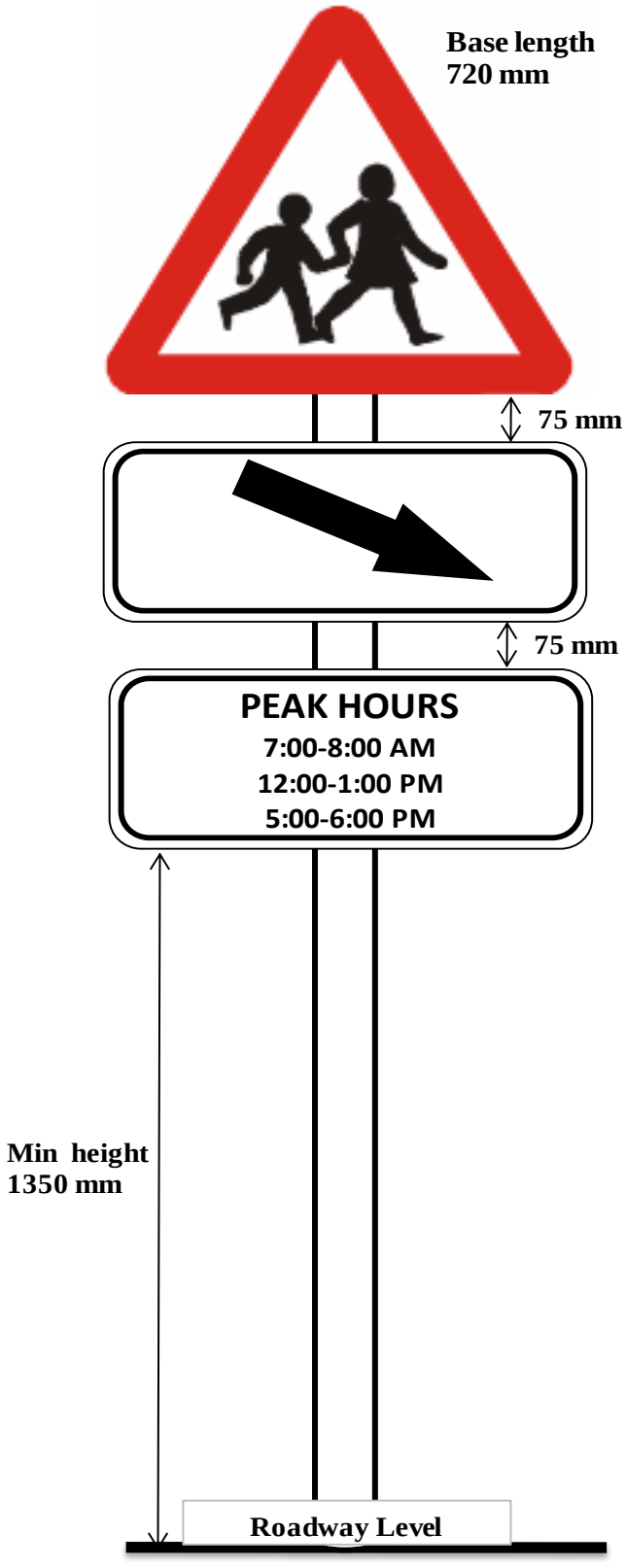


Supplementary Plate Details: All measurements in mm
Plate Dimensions: 600 x 300
Maximum heights for the Texts is as shown. Letters to be centred with respect to space shown
Other details as shown on the drawing
Background: White retro-reflective paint
Letters: Black retro-reflective paint
Specifications to conform with MOWHC (2005) General Specifications for Road and Bridge Works

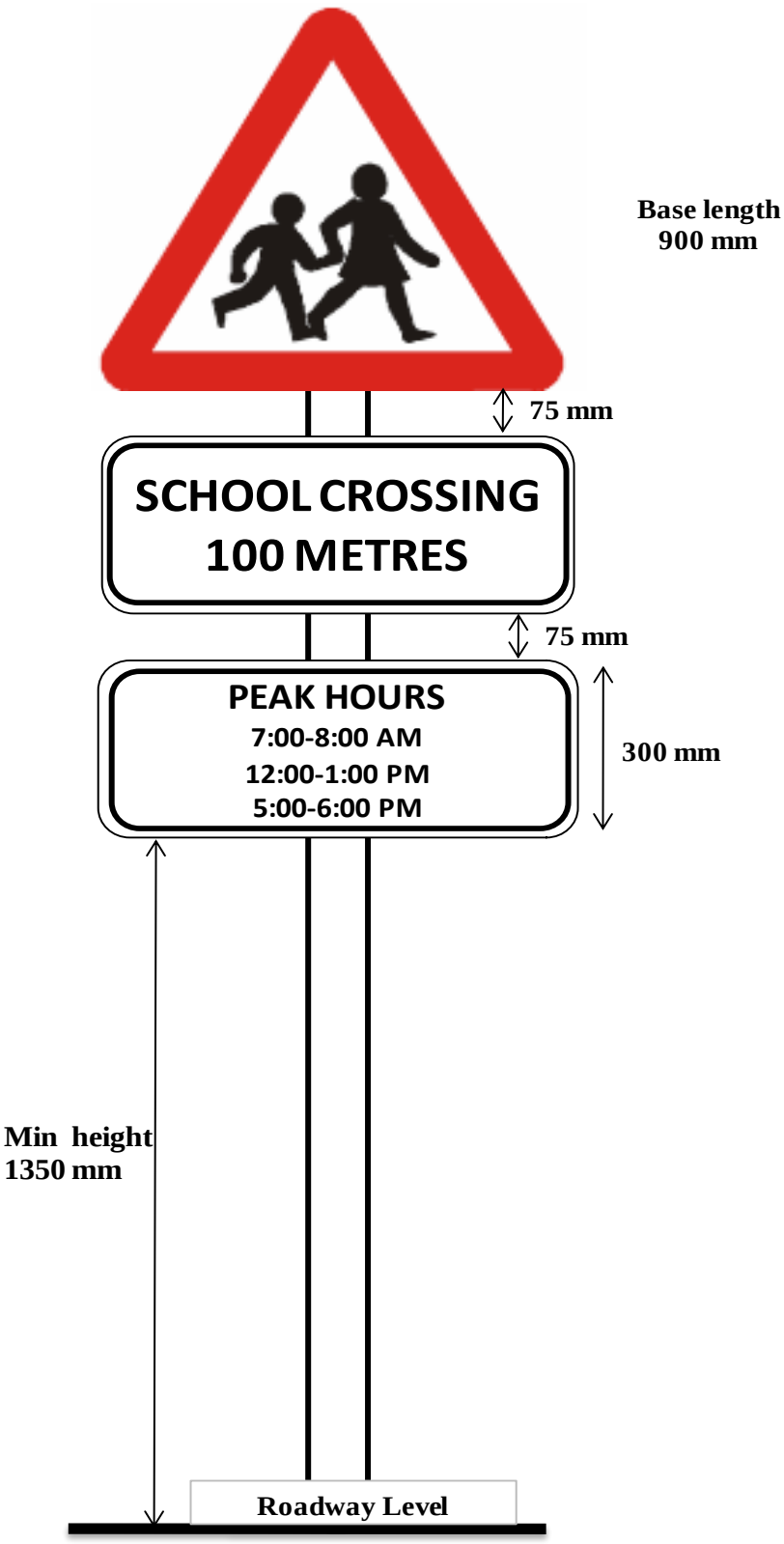
SUPPLEMENTARY PLATE 1: ARROW DETAILS



Supplementary Plate Details: All measurements in mm
Plate Dimensions: 600 x 300
Centreline of arrow inclination to the vertical : 60 degrees
Other details as shown on the drawing
Background: White retro-reflective paint
Plate Marking: Black retro-reflective paint
Specifications to conform with MOWHC (2005) General Specifications for Road and Bridge Works



SIGN AT MARKED SCHOOL CROSSING



ADVANCE WARNING SIGN FOR A SCHOOL CROSSING

FOR SPEED LIMIT (80 km/h)

APPENDIX III: BLACKSPOTS LOCATION MAPS

Vehicle-Pedestrian Accident Blackspots: Towns and Roadside Markets

School Zone Blackspots

KEY: MUJ-Mukono Junction, KSJ-Kigombya St. Johns, MB-Mbalala, KT-Kayanja trading centre, LR – Lugazi Roundabout, BST – Bulyantete Stretch, MC-Mabira Crest, MAP-Mabira After Police, MHC-Mabira Horizontal Curve, LJ-Luuka Junction, IHG-Iganga Hospital Gate, and BU-Buseyi

Speeding and Inappropriate Overtaking Blackspots