

# BLOOMBERG PHILANTHROPIES INITIATIVE FOR GLOBAL ROAD SAFETY

## KAMPALA ROUND 6

### TECHNICAL ANNEX OCTOBER 2023

## SAMPLING METHODOLOGY

The Johns Hopkins International Injury Research Unit partnered with Makerere University to conduct roadside observations between February 2021 and October 2023.

The methods for these findings were developed by the Johns Hopkins International Injury Research Unit and implemented in collaboration with Makerere University. This report provides results from observational surveys that represent the population-level (citywide) prevalence of two important road safety risk factors (speed and helmet use).

Observation sites were randomly selected, conditional on the safety of observers. There were 16 observation sites per risk factor, and a standardized protocol was used with vehicles selected for observation in a systematic quasi-random fixed sequence. Observations were performed between 7:30 a.m. and 18:15 p.m. on both weekend days and weekdays. The methods were designed to estimate citywide prevalence and cannot provide insights into interventions conducted in specific locations in the city. The data management team at Johns Hopkins International Injury Research Unit reviewed and cleaned the data to perform the analyses available in this report.

## OBSERVATION SITES AND GPS COORDINATES

### Speed (Rounds 1-6)

PARISH	LOCATION	GPS LATITUDE	GPS LONGITUDE	GPS ALTITUDE
Mutungo	Biina road near Radio Maria	0.309	32.657	1158.972
Kawempe 1	Bombo Road near NIRA Kawempe division	0.375	32.557	1194.435
Kawempe 1	Dr. Ssembeguya at Unic motel	0.381	32.564	1192.531
Najanankumbi I	Entebbe road near Polo supermarket	0.279	32.566	1217.499
Ggaba	Ggaba bypass near Chop and sizzle restaurant	0.266	32.625	1159.570
Kabalagala	Ggaba road near Rahbot brick makers (close to Seroma hardware)	0.298	32.600	1169.003
Ggaba	Kalungu road near NAIA saloon	0.299	32.588	1223.735
Ggaba	Kawuku road after flower pot makers	0.277	32.615	1143.890
Lukuli	Kirombe road opposite the transformer and the truck parking area	0.266	32.629	1167.135

Kibuye I	Lukuli opposite VM Disco sound and Events	0.297	32.595	1208.031
Kabuye I	Mbogo road from Greenhill academy	0.314	32.599	1145.147
Busega	Mugema road at the storeyed building near MK international School Signpost	0.312	32.526	1193.260
Kibuye I	Namasole road near Maggie's restaurant	0.286	32.569	1193.160
Busega	Old Mubende road near Balungi house	0.311	32.522	1167.043
Kabalagala	Tank hill road near Njuki way	0.300	32.607	1180.985
Kawempe 1	Ttula road opposite Potter's house	0.381	32.565	1195.541

### Helmet use (Rounds 1-6)

PARISH	LOCATION	GPS LATITUDE	GPS LONGITUDE	GPS ALTITUDE
Mutungo	Biina road at the junction with Butabika road	0.310	32.657	1196.600
Kawempe 1	Bombo road near Riham	0.375	32.557	1193.679
Kawempe 1	Dr. Ssembeguya road - kawempe Ttula road junction	0.381	32.564	1190.840
Najanankumbi I	Entebbe road near king's nursery and primary school signpost	0.279	32.566	1206.500
Ggaba	Gaba bypass near Oryx fuel station at the junction with Ggaba road	0.266	32.625	1151.400
Kabalagala	Ggaba road at the junction with Muyenga hill road	0.298	32.601	1167.000
Kibuye I	Hanlon road near Nsambya catholic church	0.299	32.588	1192.300
Ggaba	Kalungu road at junction with Ggaba road	0.277	32.615	1134.718
Ggaba	Kawuku road at the junction with Ggaba by pass road	0.266	32.629	1163.497
Lukuli	Kirombe road opposite interservice hotel	0.297	32.595	1185.500
Kabalagala	Mbogo road junction with sixth street	0.314	32.599	1137.100
Busega	Mugema road near Busega SS signpost	0.312	32.526	1197.601

Kibuye I	Namasole road at the junction with Entebbe road	0.286	32.569	1174.900
Busega	Old Mubende road near Star SS signpost	0.312	32.522	1164.713
Kabalagala	Tank hill road junction with Muyenga hill road (observation site opposite Italian supermarket)	0.300	32.608	1199.800
Kawempe 1	Ttula roundabout	0.381	32.565	1189.000

## FINDINGS

### OVERALL

**Table 1: Number of vehicles and occupants observed for the risk factors**

	Helmet	Speed
Vehicles observed	93,074	111,847
Occupants observed	135,406	N/A

**Table 2: Number of occupants observed by type**

Risk Factors	Number of Observations		
	Driver	Passenger	Total
Helmet	93,074	42,332	135,406

### SPEED

**Table S1: Prevalence of speeding**

	n (Percentage)	Average Speed (km/h)	Median (km/h)	85th pctl (km/h)
Vehicles observed	111,847	34 ± 10	34	44
Driving above speed limit	5,628 (5)	57 ± 6	55	62
Driving within speed limit	106,219 (95)	33 ± 9	33	41
Posted speed limit of 50 km/h for all road types				

Table S1 shows that 5% of the vehicles observed were speeding, while the average speed of speeding vehicles was 57 ± 6 km/h.

Figure S1: Histogram of speed among all vehicles

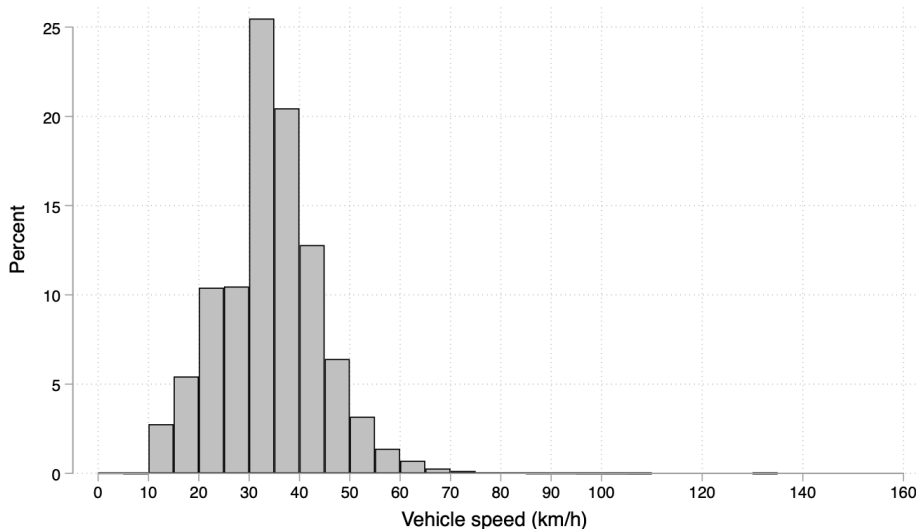
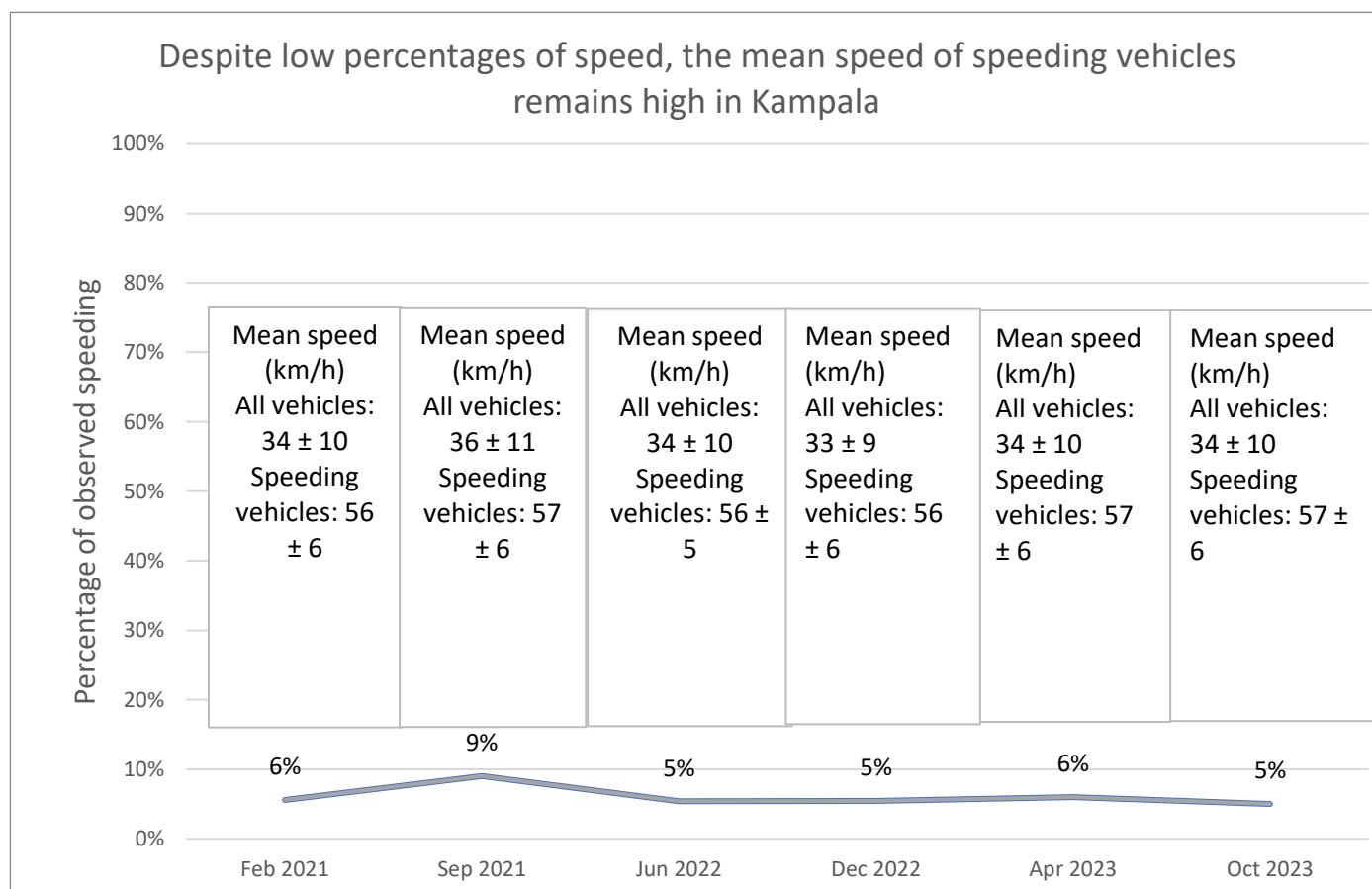


Figure S2: Trends in prevalence of speeding in Kampala

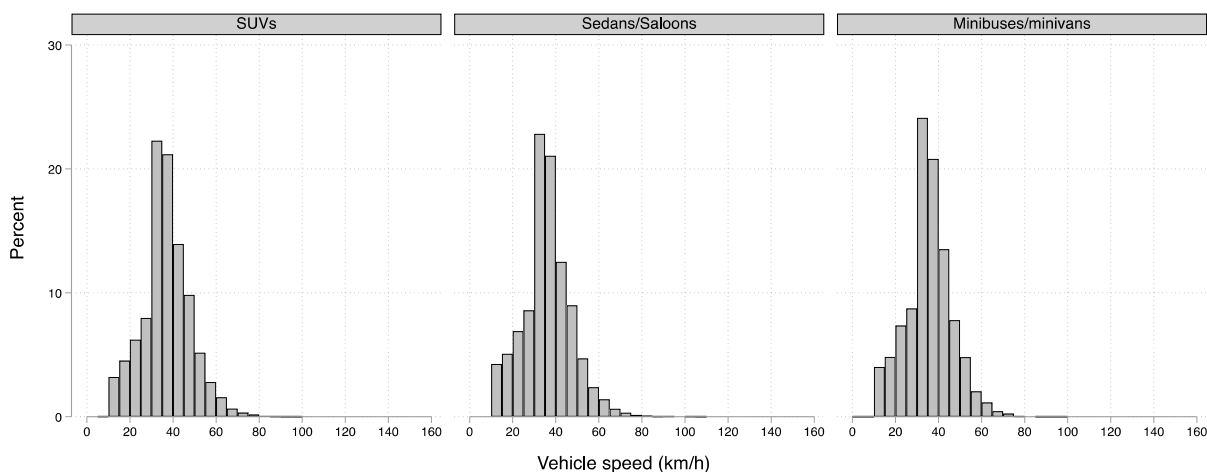


**Table S2: Percentage of speeding based on type of vehicle, n (%)**

Type of vehicle	Speeding					
	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Sedans/Saloons	1,295 (9)	13,393 (91)	14,688 (100)	35 ± 11	35	46
Pickups/Light trucks	302 (7)	3,855 (93)	4,157 (100)	34 ± 11	34	45
Trucks/Large trucks	70 (4)	1,749 (96)	1,819 (100)	32 ± 10	32	42
Buses	2 (1)	148 (99)	150 (100)	36 ± 9	36	45
Minibuses/Minivans	537 (8)	6,541 (92)	7,078 (100)	35 ± 11	35	45
SUVs	903 (10)	8,478 (90)	9,381 (100)	36 ± 11	36	47
Three-wheelers	33 (3)	926 (97)	959 (100)	30 ± 10	31	40
Motorcycles	2,486 (3)	71,124 (97)	73,610 (100)	33 ± 9	33	42
Other	0 (0)	5 (100)	5 (100)	20 ± 5	23	24

Table S2 shows that the highest percentages of speeding were among SUVs (10%), sedans/saloons (9%) and minibuses/minivans (8%).

**Figure S3: Histogram of speed by top 3 vehicle types with highest prevalence of speeding**



**Table S3: Prevalence of speeding and mean, median, and 85th percentile speed by vehicle**

Vehicle type	Prevalence n (%)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Motorcycles (n=73,610)	2,486 (3)	33 ± 9	33	42
Light vehicles* (n=35,304)	3,037 (9)	35 ± 11	35	46
Heavy vehicles† (n=1,969)	72 (4)	32 ± 10	32	42

\* Light vehicles include sedans/saloons, SUVs, minibuses/minivans, and pickups/light trucks.  
† Heavy vehicles include buses and trucks/large trucks.

Note: 959 three-wheelers and 5 from the 'other' category are excluded from this analysis, hence, the total is 110,883.

When vehicle type is collapsed into three categories, Table S3 shows that light vehicles have the highest prevalence of speeding (9%) among other vehicle types.

**Table S4: Percentage of speeding based on vehicle ownership, n (%)**

Vehicle ownership	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Commercial	273 (4)	6,820 (96)	7,093 (100)	32 ± 10	32	42
Taxi	2,468 (3)	69,247 (97)	71,715 (100)	33 ± 9	33	42
Ride-share	100 (3)	3,094 (97)	3,194 (100)	34 ± 9	34	42
Other (including private and government)	2,787 (9)	27,058 (91)	29,845 (100)	36 ± 11	35	46

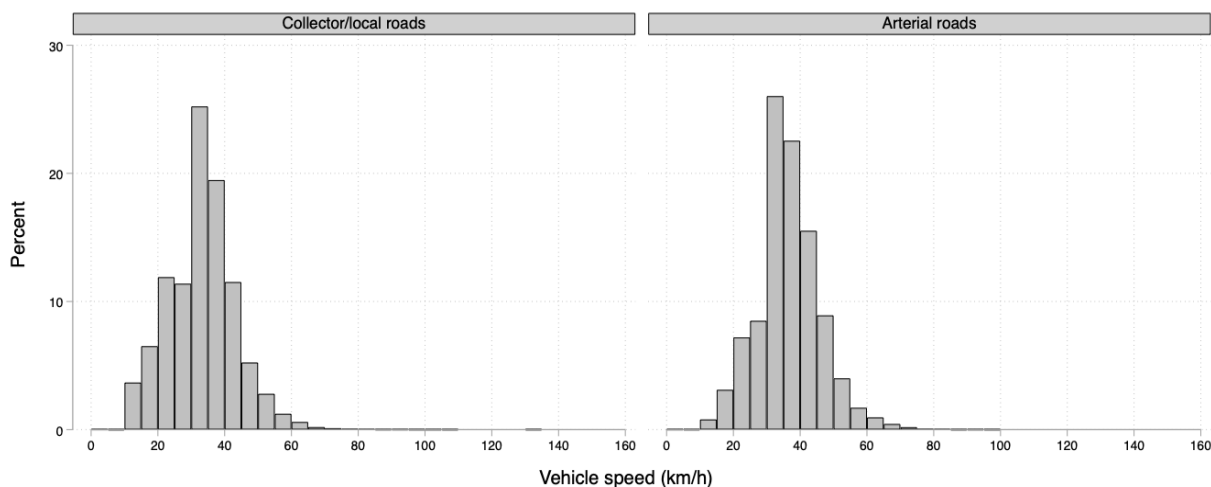
Table S4 shows that private and government vehicles had the highest percentage of speeding (9%) among other vehicle ownership types.

**Table S5: Percentage of speeding based on the road type, n (%)**

Road type	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Collector/Distributor/Local Road	3,366 (4)	72,925 (96)	76,291 (100)	33 ± 10	32	42
Arterial Road	2,262 (6)	33,294 (94)	35,556 (100)	36 ± 9	36	45

Table S5 shows that the prevalence of speeding and mean speeds were similar on arterial roads and collector/distributor/local roads.

**Figure S4: Histogram of speed by road type**



Graphs by Road type

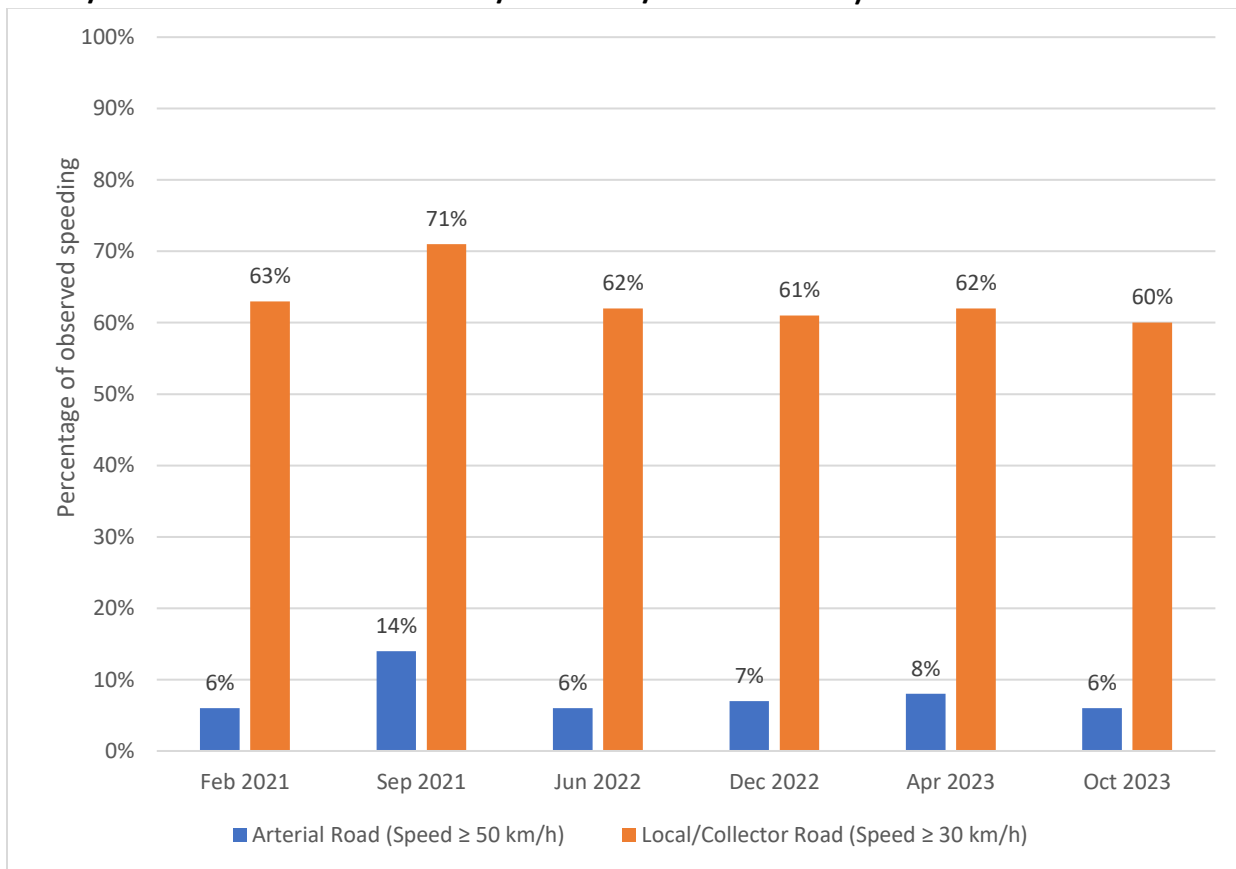


**Table S6: Percentage of speeding when the speed limit is set to 50 km/h for arterial roads and to 30/h for collector/distributor/local roads, according to global standards**

Road type	Speeding
Collector/Distributor/Local Road (Speed $\geq$ 30 km/h)	60%
Arterial Road (Speed $\geq$ 50 km/h)	6%

Table S6 shows that 60% of the vehicles observed on collector/ distributor/local roads were driving above the globally recommended speed limit of 30 km/h.

**Figure S5: Percentage of speeding by road type (using globally recommended speed limits of 50 km/h for arterial roads and 30 km/h for local/collector roads)**



**Table S8: Percentage of speeding based on day of the week, n (%)**

Day	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Weekday	3,871 (5)	70,920 (95)	74,791 (100)	34 $\pm$ 10	34	43
Weekend	1,757 (5)	35,299 (95)	37,056 (100)	33 $\pm$ 10	34	42

\* The weekend is Saturday and Sunday.

Table S8 shows that the percentages of speeding were the same on weekdays and weekends.

**Table S9: Prevalence of speeding and mean, median, and 85th percentile speed by day of the week, n (%)**

Day of the week	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Sunday	927 (7)	11,746 (93)	12,673 (100)	36 ± 9	36	45
Monday	759 (6)	12,931 (94)	13,690 (100)	35 ± 10	34	43
Tuesday	795 (6)	13,080 (94)	13,875 (100)	35 ± 10	34	44
Wednesday	1,112 (5)	22,126 (95)	23,238 (100)	33 ± 11	33	43
Thursday	848 (5)	14,702 (95)	15,550 (100)	33 ± 19	34	44
Friday	357 (4)	8,081 (96)	8,438 (100)	33 ± 10	33	42
Saturday	830 (3)	23,553 (97)	24,383 (100)	32 ± 10	32	41

Table S9 shows that speeding was most common on Sunday (7%).

**Table S10: Percentage of speeding based on observation session interval, n (%)**

Observation session interval	Yes (n=5,628)	No (n=106,219)	Total (n=111,847)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Early morning (07:45 – 09:15)	1,176 (5)	22,362 (95)	23,538 (100)	34 ± 10	34	44
Late morning (10:00 – 11:30)	1,014 (5)	20,938 (95)	21,952 (100)	33 ± 10	34	43
Afternoon (12:15 - 13:45)	1,257 (6)	20,571 (94)	21,828 (100)	34 ± 10	34	44
Late Afternoon (14:30 - 16:00)	1,148 (5)	19,726 (95)	20,874 (100)	34 ± 10	34	43
Evening (16:45 - 18:15)	1,033 (4)	22,622 (96)	23,655 (100)	33 ± 10	33	42

Table S10 shows that the prevalence of speeding was similar across different times of the day.

**Table S11: Extent of speeding**

**A) Percentage of speeding by extent of speed and vehicle type (using the number of vehicles that were speeding as the denominator)**

Type of vehicle	>5 km/h <sup>1</sup>	>10 km/h	>15 km/h	>20 km/h
<b>Overall speeding vehicles (n=5,628)</b>	<b>2,398 (43)<sup>2</sup></b>	<b>1,059 (19)</b>	<b>492 (9)</b>	<b>225 (4)</b>
Sedan/Saloon (n=1,295)	621 (48)	329 (25)	163 (13)	86 (7)
Pickups/Light trucks (n=302)	141 (47)	66 (22)	33 (11)	17 (6)
Trucks/Large trucks (n=70)	28 (40)	13 (19)	8 (11)	2 (3)
Buses (n=2)	1 (50)	0 (0)	0 (0)	0 (0)
Minibuses/Minivans (n=537)	232 (43)	105 (20)	45 (8)	18 (3)
SUVs (n=903)	461 (51)	209 (23)	106 (12)	52 (6)
Three-wheelers (n=33)	16 (48)	2 (6)	1 (3)	0 (0)
Motorcycles (n=2,486)	898 (36)	335 (13)	136 (5)	50 (2)
Other (n=0)	n/a	n/a	n/a	n/a

<sup>1</sup>The number of vehicles speeding > 5km/h includes all vehicles speeding > 5km/h, > 10 km/h, > 15 km/h and > 20 km/h.

<sup>2</sup>43% (n= 2,398) of the total number of vehicles that were speeding (n=5,628) were exceeding the posted speed limit by >5 km/h.

**B) Percentage of speeding by extent of speed and vehicle type (using all vehicles observed as the denominator)**

Type of vehicle	>5 km/h <sup>1</sup>	>10 km/h	>15 km/h	>20 km/h
<b>All vehicles (N =111,847)</b>	<b>2,398 (2)<sup>2</sup></b>	<b>1,059 (1)</b>	<b>492 (0)</b>	<b>225 (0)</b>
Sedans/Saloons (n=14,688)	621 (4)	329 (2)	163 (1)	86 (1)
Pickups/Light trucks (n =4,157)	141 (3)	66 (2)	33 (1)	17 (0)
Trucks/Large trucks (n=1,819)	28 (2)	13 (1)	8 (0)	2 (0)
Buses (n=150)	1 (1)	0 (0)	0 (0)	0 (0)
Minibuses/Minivans (n =7,078)	232 (3)	105 (1)	45 (1)	18 (0)
SUVs (n=9,381)	461 (5)	209 (2)	106 (1)	52 (1)
Three-wheelers (n=959)	16 (2)	2 (0)	1 (0)	0 (0)
Motorcycles (n=73,610)	898 (1)	335 (0)	136 (0)	50 (0)
Other (n=5)	0 (0)	0 (0)	0 (0)	0 (0)

<sup>1</sup>The number of vehicles speeding > 5km/h includes all vehicles speeding > 5km/h, > 10 km/h, > 15 km/h and > 20 km/h.

<sup>2</sup>2% (n= 2,398) of the total number of vehicles observed (N= 111,847), were exceeding the posted speed limit by >5 km/h.

## FREE FLOW SPEED

The following analyses on speeding are restricted to vehicles in free flow speed, which are defined as those traveling faster than the speed limit when/where there is no impedance for drivers to speed freely, such as bad weather, a junction, tight bend, speed bump, stop sign, crosswalk, and law enforcement activities nearby.

**Table S12: Mean, median, and 85th percentile among vehicles in free flow speed**

n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
3,316	56 ± 6	54	61

**Table S13: Mean, median, and 85th percentile among vehicles in free flow speed by vehicle type**

Vehicle type	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Motorcycles	2,431	56 ± 6	54	60
Light vehicles*	818	57 ± 6	55	62
Heavy vehicles†	67	56 ± 5	55	61

\* Light vehicles include sedans/saloons, SUVs, minibuses/minivans, and pickups/light trucks.

† Heavy vehicles include buses and trucks/large trucks.

**Table S14: Mean, median, and 85th percentile among vehicles in free flow speed by road type**

Road type	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Collector/distributor/local	2,006	56 ± 6	54	60
Arterial	1,310	56 ± 6	54	61

**Table S15: Mean, median, and 85th percentile among vehicles in free flow speed by speed limit**

Speed limit (km/h)	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
50	3,316	56 ± 6	54	61

**Table S16: Mean, median, and 85th percentile among vehicles in free flow speed by vehicle ownership**

Vehicle ownership type	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Commercial	236	56 ± 6	54	61
Taxi	2,382	56 ± 5	54	60
Ride-share	90	55 ± 6	53	60
Other (incl private and govt)	608	58 ± 7	55	64

**Table S17: Mean, median, and 85th percentile among vehicles in free flow speed by day of the week**

Day of the week	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Monday	488	56 ± 5	54	60
Tuesday*	533	56 ± 6	54	60

Wednesday	645	56 ± 6	54	60
Thursday	460	56 ± 5	54	60
Friday	196	55 ± 5	54	60
Saturday	508	56 ± 7	55	63
Sunday	486	56 ± 6	54	61

\*No observations meet the criteria of free flow speed on Tuesday.

**Table S18: Mean, median, and 85th percentile among vehicles in free flow speed by observation session interval**

Observation session interval	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Early morning (07:45 – 09:15)	751	56 ± 6	53	60
Late morning (10:00 – 11:30)	628	55 ± 5	54	60
Afternoon (12:15 - 13:45)	804	56 ± 6	54	62
Late Afternoon (14:30 - 16:00)	594	57 ± 6	55	62
Evening (16:45 - 18:15)	539	55 ± 6	54	61

## REGRESSION ANALYSIS FOR SPEEDING

**Table S19: Multivariate logistic regression model based on speeding**

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<b>Weather condition</b>		
- Dry/no rain	Ref	Ref
- Light rain	0.7 (0.6 – 0.9)	0.7 (0.6 – 0.8)
- Rain	0.9 (0.7 – 1.0)	0.7 (0.6 – 0.9)
<b>Observation session interval</b>		
- Early morning (07:45 – 09:15)	Ref	Ref
- Late morning (10:00 – 11:30)	0.9 (0.8 – 1.0)*	0.9 (0.8 – 1.0)*
- Afternoon (12:15 - 13:45)	1.2 (1.1 – 1.3)	1.1 (1.0 – 1.2)
- Late Afternoon (14:30 - 16:00)	1.1 (1.0 – 1.2)	1.1 (1.0 – 1.2)*
- Evening (16:45 - 18:15)	0.9 (0.8 – 0.9)	0.8 (0.7 – 0.9)
<b>Day of week</b>		
- Weekday	Ref	Ref
- Weekend	0.9 (0.9 – 1.0)	0.9 (0.9 - 1.0)*
<b>Road type</b>		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.5 (1.4 – 1.6)	1.4 (1.4 – 1.5)
<b>Vehicle type</b>		
- Pickups/Light trucks	Ref	Ref
- Sedans/Saloons	1.2 (1.1 – 1.4)	0.9 (0.78– 1.0)*

- Trucks/Large trucks	0.5 (0.4 – 0.7)	0.7 (0.5 – 0.9)
- Buses	0.2 (0.0 – 0.7)	0.2 (0.0 – 0.8)
- Minibuses/Minivans	1.0 (0.9 – 1.2)*	1.1 (0.9 – 1.2)*
- SUVs	1.4 (1.2 – 1.6)	1.0 (0.8 – 1.1)*
- Three-wheelers	0.5 (0.3 – 0.7)	0.9 (0.5 – 1.0)
- Motorcycles	0.4 (0.4 – 0.5)	0.7 (0.6 – 0.8)
<b>Vehicle ownership</b>		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.9 (0.8 – 1.0)*	1.1 (0.9 – 1.3)*
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	0.8 (0.6 – 1.0)*	1.0 (0.8 – 1.3)*
- Other (private, government, etc.)	2.6 (2.3 – 2.9)	2.5 (2.1 – 2.9)

\*p>0.05

Table S19 shows the following:

- Speeding was 30% less likely in rainy weather compared to dry conditions.
- Compared with early morning, vehicles were 20% less likely to speed during evenings.
- Speeding was 40% more common on arterial roads.
- Trucks/large trucks, buses, three-wheelers, and motorcycles were less likely to speed compared to pickups/light trucks by 30%, 80%, 10%, and 30%, respectively.
- Private, government owned, and other vehicles were 2.5 times more likely to speed compared to commercial vehicles.

## MOTORCYCLE-SPECIFIC ANALYSIS FOR SPEED

**Table S20: Prevalence of motorcycle speeding**

	n (Percentage)	Average Speed (km/h)	Median (km/h)	85 <sup>th</sup> pctl (km/h)
Motorcycle observed	73,610 (100)	33 ± 9	33	42
Driving above speed limit	2,486 (3)	56 ± 6	54	60
Driving within speed limit	71,124 (97)	32 ± 8	32	41
Posted speed limit of 50 km/h for all road types				

Table S20 shows that 3% of the motorcycles observed were driving above the speed limit with mean overall speed of 56 ± 6 km/h.

**Table S22: Percentage of motorcycle speeding based on the road type, n (%)**

Road type	Motorcycles speeding (n=2,486)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Collector/Distributor/Local Road (n=52,662)	1,591 (3)	32 ± 9	32	41
Arterial Road (n=20,948)	895 (4)	35 ± 9	35	43

Table S22 shows that the percentages of motorcycles speeding on collector/distributor/local and arterial roads were similar.

## HELMET USE

**Table H1: Percentage of helmet use among motorcyclists\***

Helmet use	n (Percentage)
<b>Total motorcyclists observed* (N=135,406)</b>	
<b>Overall helmet use<sup>1</sup></b>	65,914 (49)
- Correct helmet use <sup>2</sup>	53,290 (39)
- Incorrect helmet use	12,127 (9)
- Unobservable (Correctness) 3	497 (0)
<b>No helmet use</b>	69,492 (51)

\*Motorcyclists include drivers and passengers

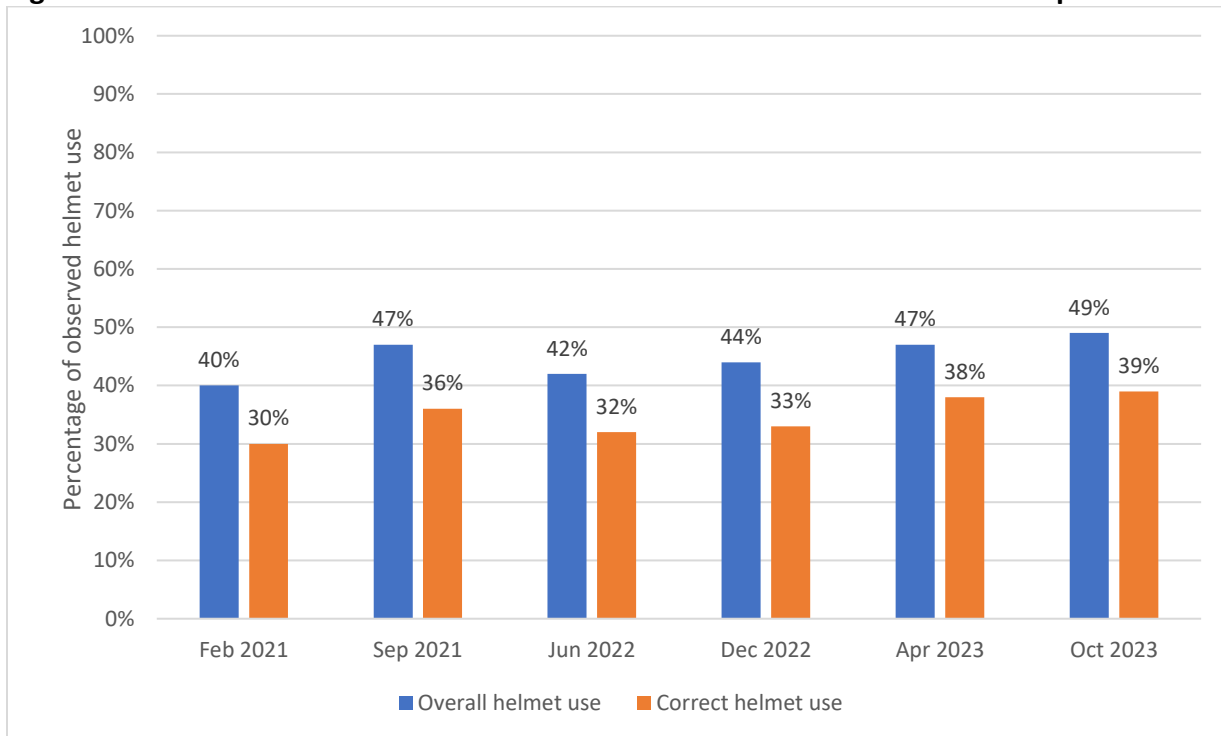
<sup>1</sup>Overall helmet use is defined as strapped or unstrapped use of a helmet of any type.

<sup>2</sup>Correct helmet use is defined as strapped use of a full-face or non-full-face helmet (but not cap helmet).

<sup>3</sup>Correct helmet use is unobservable when helmet use, strap use, or helmet type is unobservable.

Table H1 shows that overall helmet use was 49% and correct helmet use was 39% among all motorcyclists observed.

**Figure H1: Trends in overall and correct helmet use across rounds 1 to 6 in Kampala**



**Table H2: Percentage of helmet use by type of motorcyclists**

Motorcyclist type	Overall helmet use n (Percentage)	Correct helmet use n (Percentage)
Drivers (n=93,074)	64,833 (70)	52,354 (56)
Passengers (n=42,332)	1,081 (3)	936 (2)

Table H2 shows that both overall and correct helmet use was very low among motorcycle passengers.

**Table H3: Percentage of helmet use by type of motorcyclists and sex, n (%)**

	Drivers observed (n=93,074)			Passengers observed (n=42,332)		
	Males (n=92,662; 100%)	Females (n=174; 0%)	Sex unobservable (n=238; 0%)	Males (n=27,768; 66%)	Females (n=14,251; 34%)	Sex unobservable (n=313; 1%)
Overall helmet use	64,535 (70)	121 (70)	177 (74)	900 (3)	171 (1)	10 (3)
Correct helmet use	52,117 (56)	98 (56)	139 (58)	772 (3)	155 (1)	9 (3)

Table H3 shows that overall and correct helmet use was similar among drivers and passengers regardless of sex.

**Table H4: Percentage of helmet use among passengers by age and sex\*, n (%)**

	Adult passengers observed (n=39,258)			Child passengers observed (n=2,991)		
	Males (n=26,164; 67%)	Females (n=13,064; 33%)	Sex unobservable (n=30; 0%)	Males (n=1,562; 52%)	Females (n=1,166; 39%)	Sex unobservable (n=263; 9%)
Overall helmet use	837 (3)	155 (1)	6 (20)	60 (4)	16 (1)	4 (2)
Correct helmet use	712 (3)	142 (1)	5 (17)	57 (4)	13 (1)	4 (2)

\*Age was not observable for 83 passengers

Table H4 shows that correct helmet use was rare among passengers irrespective of age and sex.

**Table H5: Percentage of helmet use by motorcyclist type and day of the week, n (%)**

	Weekday (n=90,645)		Weekend (n=44,761)	
	Drivers (n=62,345; 69%)	Passengers (n=28,300; 31%)	Drivers (n=30,729; 69%)	Passengers (n=14,032; 31%)
Overall helmet use	44,531 (71)	802 (3)	20,302 (66)	279 (2)
Correct helmet use	36,291 (58)	701 (2)	16,729 (54)	235 (2)

Table H5 shows that overall and correct helmet use among drivers was slightly higher on weekdays than weekends, while overall and correct helmet use among passengers was rare on both weekdays and weekends.



**Table H6: Prevalence of overall and correct helmet use by day of the week, n (%)**

Day of week	N (n= 135,406)	Overall Helmet Use (n=65,914)	Correct Helmet Use (n=53,290)
Monday	15,912	7,534 (47)	5,945 (37)
Tuesday	13,267	6,854 (52)	5,614 (42)
Wednesday	31,298	15,922 (51)	13,288 (42)
Thursday	13,678	6,816 (50)	5,703 (42)
Friday	16,490	8,207 (50)	6,442 (39)
Saturday	16,821	8,085 (48)	6,448 (38)
Sunday	27,940	12,496 (45)	9,850 (35)

Table H6 shows that correct helmet use varied within a range of 35% to 42% across different days of the week.

**Table H7: Prevalence of helmet use by motorcyclists based on time of day, n (%)**

Time of day	Drivers observed			Passengers observed		
	N (n=93,074) <sup>1</sup>	Overall Helmet Use (n=64,833)	Correct Helmet Use (n=52,354)	N (n=42,332) <sup>2</sup>	Overall Helmet Use (n=1,081)	Correct Helmet Use (n=936)
Early morning (07:45 - 09:15)	19,320	13,872 (72)	10,907 (56)	7,723	149 (2)	133 (2)
Late morning (10:00 – 11:30)	18,100	12,521 (69)	10,191 (56)	8,316	247 (3)	210 (3)
Afternoon (12:15 - 13:45)	19,027	13,044 (69)	10,439 (55)	8,431	173 (2)	142 (2)
Late Afternoon (14:30 - 16:00)	16,924	11,603 (69)	9,659 (57)	8,452	262 (3)	234 (3)
Evening (16:45 - 18:15)	19,703	13,793 (70)	11,158 (57)	9,410	250 (3)	217 (2)

<sup>1</sup> indicates the total number of drivers observed

<sup>2</sup> indicates the total number of passengers observed

Table H7 shows that correct helmet use among drivers ranged from 55% to 57% across different times of the day, while that of passengers remained rare (2% to 3%).

**Table H8: Prevalence of overall and correct helmet use by road type, n (%)**

Road type	N (n= 135,406)	Overall Helmet Use (n=65,914)	Correct Helmet Use (n=53,290)
Collector/distributor/local roads	102,729	49,104 (48)	40,091 (39)
Arterial roads	32,677	16,810 (51)	13,199 (40)

Table H8 shows that correct helmet use was low on both collector/distributor/local roads and arterial roads.

**Table H10: Prevalence of overall and correct helmet use by motorcycle ownership and by type of motorcyclist, n (%)**

Vehicle ownership	Drivers observed			Passengers observed		
	N (n=93,074)	Overall Helmet Use (n=64,833)	Correct Helmet Use (n=52,354)	N (n=42,332) <sup>2</sup>	Overall Helmet Use (n=1,081)	Correct Helmet Use (n=936)
Commercial	1,869	1,223 (65)	927 (50)	239	8 (3)	8 (3)
Taxi	84,514	58,004 (69)	46,459 (55)	39,199	912 (2)	791 (2)
Ride-share	4,525	4,207 (93)	3,783 (84)	2,471	112 (5)	103 (4)
Other (incl private and govt)	2,166	1,399 (65)	1,185 (55)	423	49 (12)	34 (8)

Table H10 shows that correct helmet use was the highest among drivers of ride-share motorcycles (84%), while passenger helmet use was rare for all motorcycle ownership types (2% to 8%).

## REGRESSION ANALYSIS FOR HELMET USE

**Table H11: Multivariate logistic regression model for correct helmet use**

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<b>Age</b>		
- Under 18 years	Ref	Ref
- 18 years and older	19.8 (16.3 – 24.1)	1.6 (1.2 – 2.0)
- Unobservable	10.0 (6.8 – 14.9)	1.0 (0.6 – 1.5)*
<b>Sex</b>		
- Female	Ref	Ref
- Male	43.9 (38.7 – 49.7)	2.1 (1.8 – 2.4)
- Unobservable	20.6 (16.4 -25.8)	2.4 (1.8 – 3.1)
<b>Motorcyclist type</b>		
- Driver	Ref	Ref
- Passenger	0.02 (0.02 – 0.02)	0.02 (0.02 – 0.02)
<b>Weather condition</b>		
- Dry/no rain	Ref	Ref
- Light rain/drizzle	1.0 (1.0 – 1.0)*	1.1 (1.0 – 1.1)
- Rain	1.4 (1.3 – 1.4)	1.6 (1.5 – 1.7)
<b>Observation session interval</b>		
- Early morning (07:45 - 09:15)	Ref	Ref
- Late morning (10:00 – 11:30)	0.9 (0.9 – 1.0)	0.9 (0.9 – 1.0)
- Afternoon (12:15 - 13:45)	0.9 (0.9 – 0.9)	1.0 (0.9 – 1.0)
- Late Afternoon (14:30 - 16:00)	0.9 (0.9 – 1.0)	1.0 (1.0 – 1.1)*
- Evening (16:45 - 18:15)	0.9 (0.9 – 1.0)	1.0 (1.0 – 1.1)*
<b>Day of week</b>		
- Weekday	Ref	Ref
- Weekend	0.8 (0.8 – 0.9)	0.8 (0.8 – 0.8)
<b>Road type</b>		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.1 (1.0 – 1.1)	1.0 (1.0 – 1.0)

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<b>Vehicle ownership</b>		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.8 (0.7 – 0.8)	1.2 (1.2 – 1.4)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	1.6 (1.4 – 1.7)	4.7 (4.2 – 5.2)
- Other (private, government, etc.)	1.1 (1.0 – 1.3)*	1.3 (1.1 - 1.4)

\*p>0.05

Table H11 shows the following:

- Correct helmet use was 1.6 times more likely among those 18 years or older compared to those under 18 years.
- Correct helmet use was almost twice as common among males compared to females.
- Correct helmet use among passengers was rare.
- Correct helmet use was 1.6 times more common in rainy weather compared to dry conditions.
- Correct helmet use was 20% less likely on weekends.
- Compared with commercial motorcyclists, ride-share motorcyclists were almost 5 times more likely to use helmets correctly, and private, government-owned and other motorcyclists and, taxi motorcyclists were 30 and 20% more likely to wear helmets correctly, respectively.