

# **BLOOMBERG PHILANTHROPIES INITIATIVE FOR GLOBAL ROAD SAFETY**

## **KAMPALA ROUND 4**

### **TECHNICAL ANNEX OCTOBER 2022**

## SAMPLING METHODOLOGY

The Johns Hopkins International Injury Research Unit partnered with Makerere University to conduct roadside observations in October 2022.

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 population-level (citywide) prevalence of 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 1-5)

DIVISION	LOCATION	GPS LATITUDE	GPS LONGITUDE	GPS ALTITUDE
Mutungo	Biina road near Radio Maria	0.309	32.648	1194.0
Kawempe 1	Bombo road near NIRA Kawempe division	0.372	32.557	1189.506
Kawempe 1	Dr. Ssembeguya road at UNIC motel	0.379	32.563	1203.831
Najanankumbi I	Entebbe road near Polo supermarket	0.283	32.567	1202.372
Ggaba	Ggaba bypass near Chop and sizzle restaurant	0.265	32.627	1167.100
Kabalagala	Ggaba road near Rhabot brick makers (close to Seroma hardware)	0.283	32.610	1154.789
Ggaba	Kalungu road near NAIA saloon	0.277	32.616	1143.775
Ggaba	Kawuku road just after the flower pot makers	0.266	32.630	1161.524
Lukuli	Kirombe road oppsite the transformer and the truck parking area	0.293	32.596	1201.672
Kibuye I	Lukuli opposite VM Disco sound and events	0.281	32.595	1194.891

Kabuye I	Mbogo road from Greenhill Academy	0.313	32.599	1151.647
Busega	Mugema road at the storeyed building near MK international school signpost	0.307	32.524	1191.837
Kibuye I	Namasole road near Maggie's restaurant	0.285	32.569	1186.180
Busega	Old mubende near Balungi house	0.312	32.524	1184.187
Kabalagala	Tankhill road near Njuki way road	0.294	32.613	1212.929
Kawempe 1	Ttula road opposite Potter's house	0.369	32.569	1199.480

### Helmet Use (Rounds 1-5)

DIVISION	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. Sembeguya road-Kawempe-Ttula road junction	0.381	32.564	1190.840
Najanankumbi I	Entebbe road near Kings nursery and primary sign post	0.279	32.566	1206.500
Ggaba	Ggaba bypass opposite Oryx fuel station at the Junction with Ggaba road	0.266	32.625	1151.400
Kabalagala	Ggaba road 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 bypass road	0.266	32.629	1163.497
Lukuli	Kirombe road opposite Interservice hotel	0.297	32.595	1185.500
Kabalagala	Mbogo road at the junction with 6th 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	Tankhill road at the junction with Muyenga hill road (observation site just opposite Italian supermarket)	0.300	32.608	1199.800
Kawempe 1	Ttula roundabout	0.381	32.565	1189.000
Mutungo	Biina road at the junction with Butabika road	0.310	32.657	1196.600

## FINDINGS

### OVERALL

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

	Helmet	Speed
Vehicles observed	75,583	92,320
Occupants observed	113,348	n/a

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

Risk Factors	Number of Observations		
	Driver	Passenger	Total
Helmet	75,583	37,765	113,348

### SPEED

**Table S1: Prevalence of speeding**

	n (Percentage)	Average Speed (km/h)	Median (km/h)	85th pctl (km/h)
Vehicles observed	92,320	33 ± 9	33	44
Driving above speed limit	5,018 (5)	56 ± 6	55	62
Driving within speed limit	87,302 (95)	32 ± 9	32	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 56 km/h.

Figure S1: Histogram of speed among all vehicles

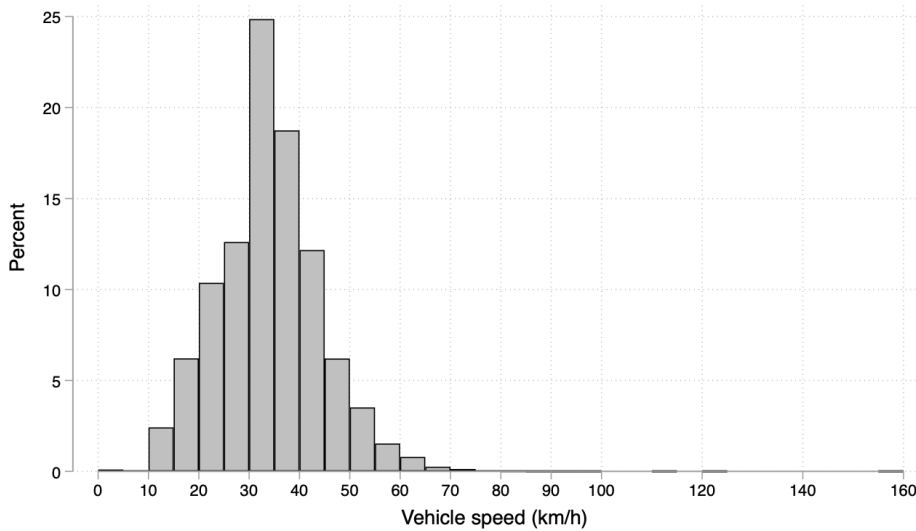
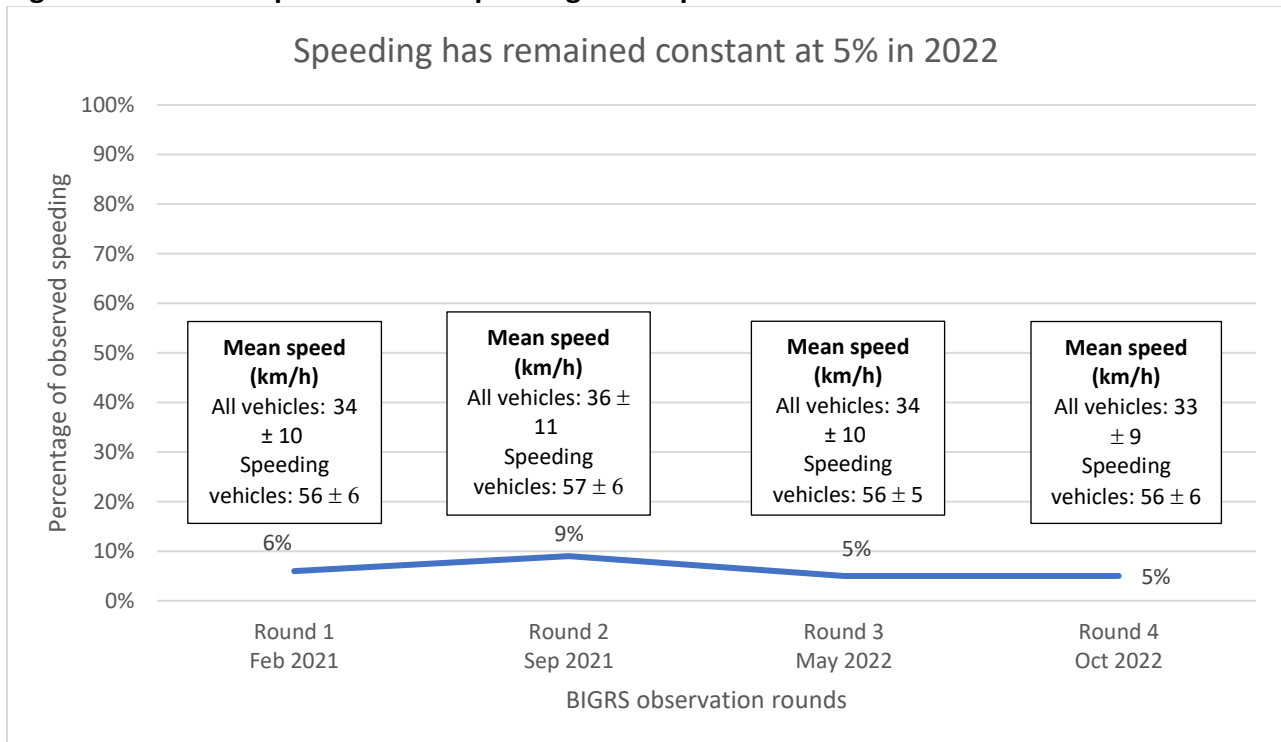


Figure S2: Trends in prevalence of speeding in Kampala

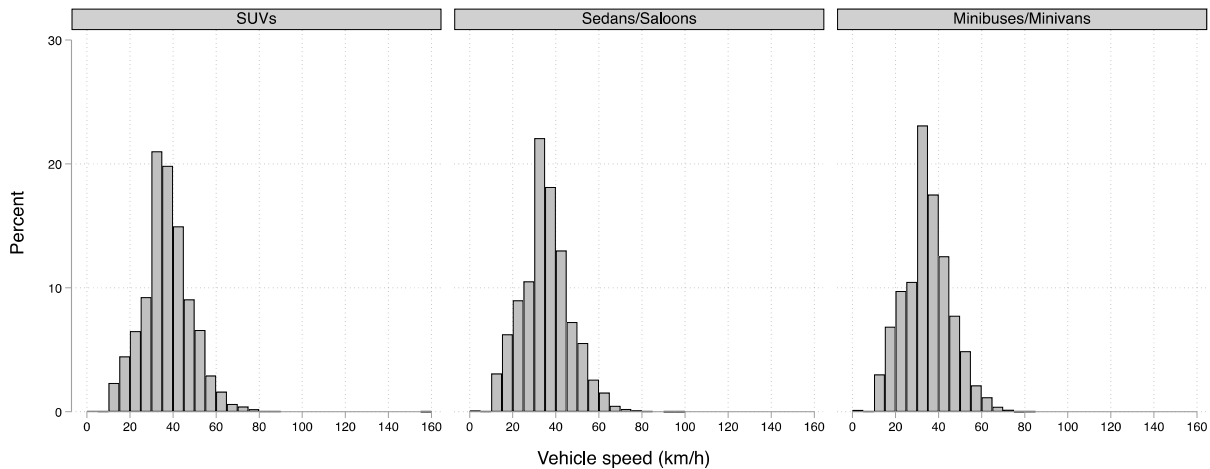


**Table S2: Percentage of speeding based on type of vehicle, n (%)**

Type of vehicle	Speeding					
	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Sedans/Saloons	1,505 (9)	14,488 (91)	15,993 (100)	35 ± 11	34	46
Pickups/Light trucks	299 (7)	3,715 (93)	4,014 (100)	33 ± 11	33	45
Trucks/Large trucks	72 (3)	2,139 (97)	2,211 (100)	30 ± 10	30	41
Buses	13 (7)	177 (93)	190 (100)	34 ± 12	32	44
Minibuses/Minivans	476 (8)	5,823 (92)	6,299 (100)	34 ± 11	34	45
SUVs	820 (11)	6,693 (89)	7,513 (100)	37 ± 11	36	48
Three-wheelers	11 (2)	604 (98)	615 (100)	27 ± 10	27	38
Motorcycles	1,822 (3)	53,661 (97)	55,483 (100)	33 ± 9	32	41
Other	0 (0)	2 (100)	2 (100)	30 ± 4	30	32

Table S2 shows that the highest percentages of speeding were among SUVs (11%), sedans/saloons (9%) and minibuses/minivans (8%).

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



Graphs by Top 3 speeding vehicle types

**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= 55,483)	1,822 (3)	33 ± 9	32	41
Light vehicles* (n= 33,819)	3,100 (9)	35 ± 11	34	46
Heavy vehicles† (n= 2,401)	85 (4)	31 ± 11	30	41

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

Note: 615 three-wheelers and 2 from the 'other' category are excluded from this analysis, hence, the total is 91,703.

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.

Figure S4: Percentage of speeding by vehicle type across all rounds

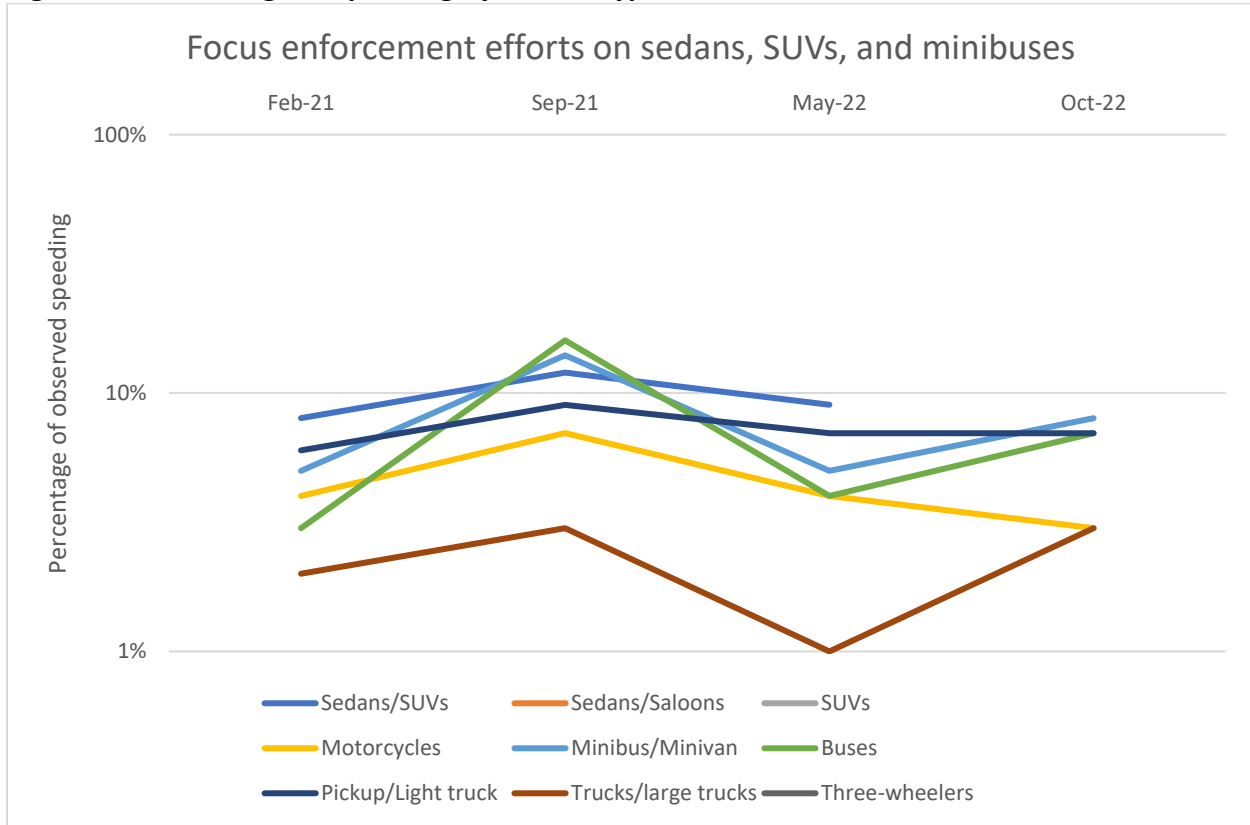


Table S4: Percentage of speeding based on vehicle ownership, n (%)

Vehicle ownership	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Commercial	253 (4)	5,612 (96)	5,865 (100)	31 ± 11	31	42
Taxi	1,855 (3)	51,783 (97)	53,638 (100)	33 ± 9	32	42
Ride-share	103 (3)	3,212 (97)	3,315 (100)	33 ± 9	33	42
Other (including private and government)	2,807 (10)	26,695 (90)	29,502 (100)	35 ± 11	35	46

Table S4 shows that private and government vehicles had the highest percentage of speeding (10%) among other vehicle ownership types.

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

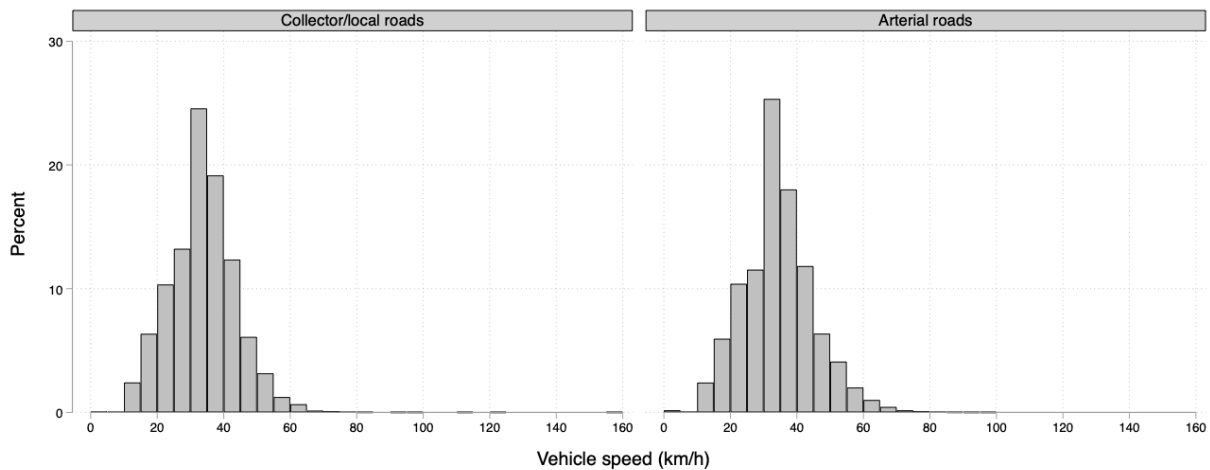
Road type	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)



Collector/Distributor/Local Road	2,654 (5)	55,644 (95)	58,298 (100)	33 ± 10	33	43
Arterial Road	2,364 (7)	31,658 (93)	34,022 (100)	34 ± 11	33	44

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

**Figure S5: Histogram of speed by road type**

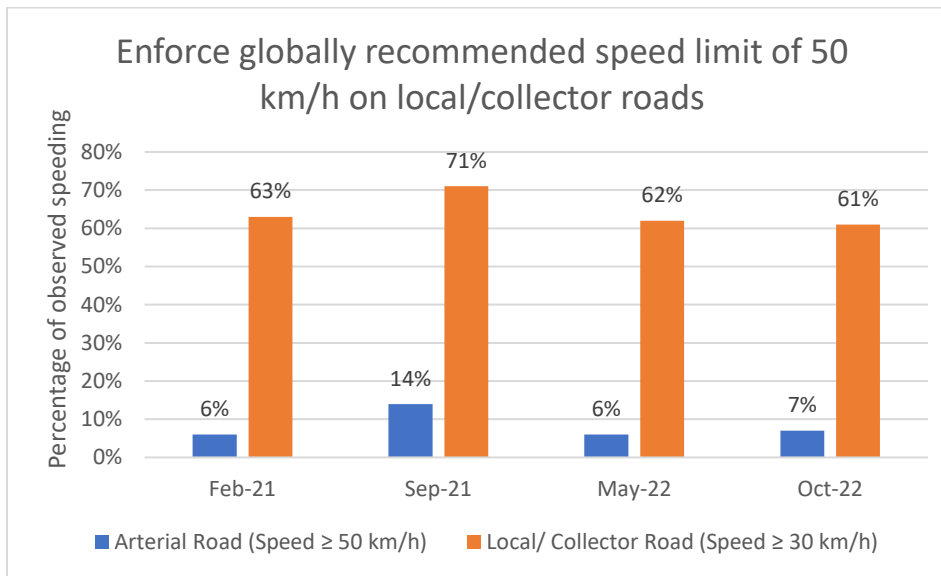


**Table S6: Percentage of speeding when the speed limit is set to 50 km/h for arterial roads and to 30/h for collector/distributor/local roads, according to global standards**

Road type	Speeding
Collector/Distributor/Local Road (Speed ≥ 30 km/h)	61%
Arterial Road (Speed ≥ 50 km/h)	7%

Table S6 shows that 61% of the vehicles observed on collector/ distributor/local roads were driving above the globally recommended speed limit of 30 km/h.

**Figure S6: Percentage of speeding by road type (using globally recommended speed limits of 30 km/h for arterial roads and 50 km/h for local/collector roads)**



**Table S7: Prevalence of speeding based on pedestrian access, n (%)**

Level of pedestrian access	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Partially controlled <sup>1</sup>	1,299 (15)	7,114 (85)	8,413 (100)	39 ± 11	38	51
No access control	3,719 (4)	80,188 (96)	83,907 (100)	33 ± 10	33	42

<sup>1</sup>Partially controlled roads are those where pedestrians can have limited access to the road. For example, limited number of direct accesses, such as main roadways with frontage or service roads running parallel. The partially controlled roads observed in Kampala were arterial roads.

Table S7 shows that speeding was 15% more common on roads with partially controlled pedestrian access than on roads freely accessible to pedestrians.

**Table S8: Percentage of speeding based on weekday, n (%)**

Day	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Weekday	3,063 (5)	57,195 (95)	60,258 (100)	33 ± 10	33	43
Weekend	1,955 (6)	30,107 (94)	32,062 (100)	34 ± 11	33	44

\* The weekend is Saturday and Sunday.

Table S8 shows that the percentages of speeding were similar 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=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Sunday	1,127 (10)	10,656 (90)	11,783 (100)	37 ± 11	32	41
Monday	653 (4)	16,750 (96)	17,403 (100)	32 ± 10	31	41
Tuesday*	n/a	n/a	n/a			
Wednesday	699 (4)	16,394 (96)	17,093 (100)	31 ± 10	35	44
Thursday	742 (6)	11,641 (94)	12,383 (100)	35 ± 9	36	45
Friday	969 (7)	12,410 (93)	13,379 (100)	36 ± 9	32	41
Saturday	828 (4)	19,451 (96)	20,279 (100)	32 ± 10	36	46

\*No observations were made on Tuesday.

Table S9 shows that speeding was most common on Sunday (10%).

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

Observation session interval	Yes (n=5,018)	No (n=87,302)	Total (n=92,320)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Early morning (07:45 – 09:15)	1,194 (6)	18,011 (94)	19,205(100)	34 ± 10	34	44
Late morning (10:00 – 11:30)	934 (5)	17,021 (95)	17,955 (100)	33 ± 10	33	43
Afternoon (12:15 - 13:45)	988 (6)	16,579 (94)	17,567 (100)	33 ± 10	33	43
Late Afternoon (14:30 - 16:00)	926 (5)	16,608 (95)	17,534 (100)	33 ± 10	33	43
Evening (16:45 - 18:15)	976 (5)	19,083 (95)	20,059 (100)	33 ± 10	33	43

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 =5,018)</b>	<b>2,031 (40)<sup>2</sup></b>	<b>828 (17)</b>	<b>381 (8)</b>	<b>136 (3)</b>
Sedan/Saloon (n=1,505)	640 (43)	281 (19)	123 (8)	46 (3)
Pickups/Light trucks (n =299)	126 (42)	63 (21)	34 (11)	8 (3)
Trucks/Large trucks (n =72)	23 (32)	7 (10)	1 (1)	1 (1)
Buses (n =13)	6 (46)	2 (15)	1 (8)	0 (0)
Minibuses/Minivans (n =476)	203 (43)	75 (16)	33 (7)	9 (2)
Sedans/Saloons/SUVs/4WDs (n =820)	365 (45)	170 (21)	90 (11)	39 (5)
Three-wheelers (n=11)	2 (18)	1 (9)	0 (0)	0 (0)
Motorcycles (n =1,822)	666 (37)	229 (13)	99 (5)	33 (2)
Other (n =0)	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>40% (n= 2,031) of the total number of vehicles that were speeding (n=5,018) 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 =92,320)</b>	<b>2,031 (2)<sup>2</sup></b>	<b>828 (1)</b>	<b>381 (0)</b>	<b>136 (0)</b>
Sedans/Saloons (n=15,993)	640 (4)	281 (2)	123 (1)	46 (0)
Pickups/Light trucks (n =4,014)	126 (3)	63 (2)	34 (1)	8 (0)
Trucks/Large trucks (n =2,211)	23 (1)	7 (0)	1 (0)	1 (0)
Buses (n =190)	6 (3)	2 (1)	1 (1)	0 (0)
Minibuses/Minivans (n =6,299)	203 (3)	75 (1)	33 (1)	9 (0)
SUVs (n = 7,513)	365 (5)	170 (2)	90 (1)	39 (1)
Three-wheelers (n=615)	2 (0)	1 (0)	0 (0)	0 (0)
Motorcycles (n =55,483)	666 (1)	229 (0)	99 (0)	33 (0)
Other (n =2)	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= 2,031) of the total number of vehicles observed (N= 92,320), 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)
2,600	56 ± 5	54	60

**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	1,776	56 ± 5	54	60
Light vehicles*	743	57 ± 6	55	62
Heavy vehicles†	81	55 ± 4	55	60

\* 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	1,382	56 ± 5	54	60
Arterial	1,218	56 ± 6	55	62

**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	2,600	56 ± 5	54	60

**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	218	56 ± 5	55	61
Taxi	1,779	56 ± 5	54	60
Ride-share	87	55 ± 4	53	58
Other (incl private and govt)	516	57 ± 7	55	63

**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	314	56 ± 6	54	60
Tuesday*	n/a	n/a	n/a	n/a

Wednesday	421	56 ± 5	55	60
Thursday	424	56 ± 5	54	60
Friday	491	56 ± 5	54	61
Saturday	472	56 ± 6	55	60
Sunday	478	56 ± 6	55	62

\*No observations were made 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)	655	55 ± 5	54	60
Late morning (10:00 – 11:30)	523	56 ± 6	54	60
Afternoon (12:15 - 13:45)	465	56 ± 6	55	61
Late Afternoon (14:30 - 16:00)	459	56 ± 5	55	62
Evening (16:45 - 18:15)	498	56 ± 5	54	60

## 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	0.6 (0.5 – 0.7)	0.5 (0.4 – 0.5)
- Rain	1.3 (1.1 – 1.5)	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)	0.8 (0.8 – 0.9)	0.8 (0.7 – 0.9)
- Afternoon (12:15 - 13:45)	0.9 (0.8 – 1.0)	0.8 (0.8 – 0.9)
- Late Afternoon (14:30 - 16:00)	0.8 (0.8 – 0.9)	0.8 (0.7 – 0.9)
- Evening (16:45 - 18:15)	0.8 (0.7 – 0.8)	0.7 (0.6 – 0.8)
<b>Day of week</b>		
- Weekday	Ref	Ref
- Weekend	1.2 (1.1 – 1.3)	1.2 (1.1 – 1.3)
<b>Road type</b>		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.6 (1.5 – 1.7)	0.9 (0.9 – 1.0)
<b>Level of pedestrian access</b>		
- No access control	Ref	Ref
- Partially controlled	3.9 (3.7 – 4.2)	4.0 (3.6 – 4.3)

<b>Vehicle type</b>		
- Pickups/Light trucks	Ref	Ref
- Sedans/Saloons	1.3 (1.1 – 1.5)	1.1 (0.9 – 1.3)
- Trucks/Large trucks	0.4 (0.3 – 0.5)	0.5 (0.4 – 0.7)
- Buses	0.9 (0.5 – 1.6)	1.0 (0.6 – 1.8)
- Minibuses/Minivans	1.0 (0.9 – 1.2)	1.0 (0.9 -1.2)
- SUVs	1.5 (1.3 – 1.7)	1.3 (1.1 – 1.5)
- Three-wheelers	0.2 (0.1 – 0.4)	0.3 (0.2 – 0.6)
- Motorcycles	0.4 (0.4 – 0.5)	0.7 (0.6 – 0.8)
<b>Vehicle ownership</b>		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.8 (0.7 – 0.9)	0.9 (0.8 – 1.1)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	0.7 (0.6 – 0.9)	0.8 (0.6 – 1.1)
- Other (private, government, etc.)	2.3 (2.0 – 2.7)	1.7 (1.5 – 2.0)

Table S19 shows the following:

- Speeding was less prevalent in rainy weather compared to dry conditions.
- Speeding was similar across different times of the day.
- Speeding was 20% more common on weekends.
- Speeding was 10% less common on arterial roads.
- Speeding was 4 times more likely on partially controlled roads compared to roads freely accessible to pedestrians.
- SUVs were 30% more likely to speed compared to pickups/light trucks.
- Private and government owned vehicles were 70% more likely to speed compared to commercial vehicles.

## MOTORCYCLE-SPECIFIC ANALYSIS FOR SPEED

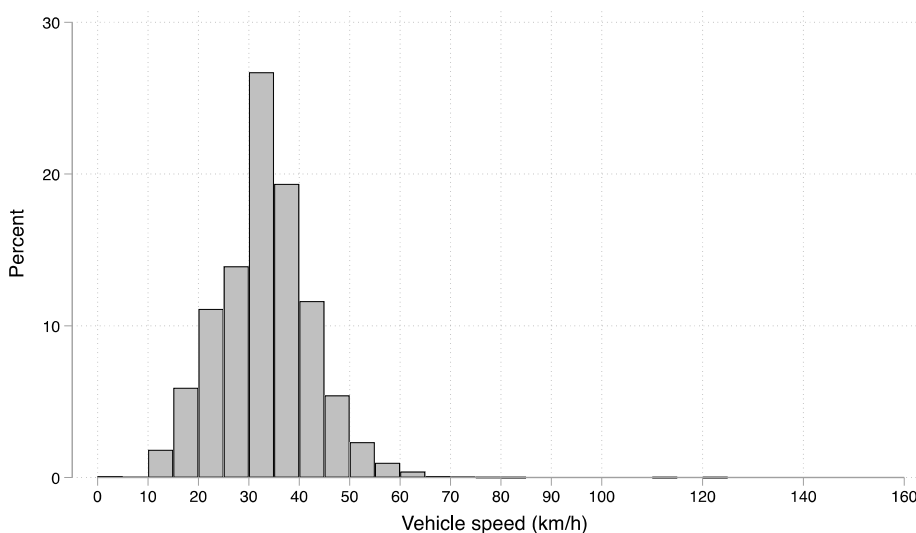
**Table S20: Prevalence of motorcycle speeding**

	n (Percentage)	Average Speed (km/h)	Median (km/h)	85 <sup>th</sup> pctl (km/h)
Motorcycles observed	55,483 (100)	33 ± 9	32	41
Driving above speed limit	1,822 (3)	58 ± 5	54	60
Driving within speed limit	53,661 (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 posted speed limit with mean overall speed of 58 ± 5 km/h.

The following tables and figures show the prevalence of speeding of **all motorcycles observed** (not just the motorcycles that were speeding).

**Figure S7: Histogram of speed of motorcycles**



**Table S21: Percentage of speeding based on motorcycle ownership type, n (%)**

Vehicle ownership	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85 <sup>th</sup> pctl (km/h)
Commercial (n=746)	42 (6)	33 ± 10	33	44
Taxi (n=49,690)	1,532 (3)	33 ± 9	32	41
Ride-share (n=3,224)	91 (3)	33 ± 9	33	42
Other (including private and government) (n=1,823)	157 (9)	35 ± 11	34	46

Table S21 shows the numbers and percentages of each type (commercial, taxi, ride-share and other) of motorcycle that was speeding among the total number of each type of motorcycle observed. For example, of the 746 commercial motorcycles observed, 6% were found to be speeding.

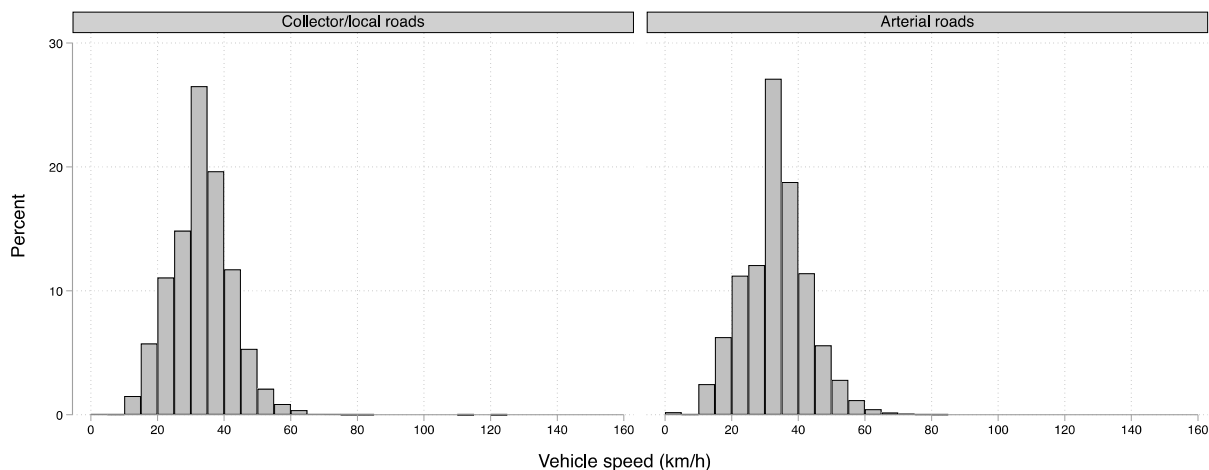


**Table S22: Percentage of motorcycle speeding based on the road type, n (%)**

Road type	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Collector/Distributor/Local Road (n=36,730)	1,068 (3)	33 ± 9	32	41
Arterial Road (n=18,753)	754 (4)	33 ± 10	32	42

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

**Figure S8: Histogram of motorcycle speeding by road type**



Graphs by Road type

Figure S7 shows that the distribution of motorcycle speeds on collector/distributor/local roads and arterial roads were similar.

**Table S23: Percentage of motorcycle 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 ≥ 30 km/h)	60%
Arterial Road (Speed ≥ 50 km/h)	4%

Table S23 shows that that 60% of the motorcycles observed on collector/distributor/local roads were driving above the globally recommended speed limit of 30 km/h.

**Table S24: Prevalence of motorcycle speeding based on pedestrian access, n (%)**

Level of pedestrian access	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Partially controlled <sup>1</sup> (n=3,825)	295 (8)	37 ± 9	36	45
No access control (n=51,658)	1,527 (3)	32 ± 9	32	41

<sup>1</sup>Partially controlled roads are those where pedestrians can have limited access to the road. For example, limited number of direct accesses, such as main roadways with frontage or service roads running parallel. The partially controlled roads observed in Kampala were arterial roads.

Table S24 shows that 8% of the motorcycles observed on roads with partially controlled pedestrian access were driving above the posted speed limit.

**Table S25: Prevalence of motorcycle speeding by weekday (weekday and weekend)**

Day of the week	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Weekday (n=35,455)	1,104 (3)	33 ± 9	32	41
Weekend (n=20,028)	718 (4)	32 ± 10	32	42

Table S25 shows that the percentages of motorcycles, mean and median speeds are similar on weekends and weekdays.

**Table S26: Prevalence of motorcycle speeding and mean, median, and 85th percentile speed by day of the week, n (%)**

Day of the week	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Sunday (n=7,014)	349 (5)	35 ± 10	34	44
Monday (n=10,310)	219 (2)	31 ± 9	32	40
Tuesday (n=0)*	n/a*	n/a*	n/a*	n/a*
Wednesday (n=9,439)	262 (3)	30 ± 9	30	40
Thursday (n=7,658)	303 (4)	35 ± 9	34	43
Friday (n=8,048)	320 (4)	35 ± 8	35	43
Saturday (n=13,014)	369 (3)	31 ± 9	31	40

\*No observations were made on Tuesday.

Table S26 shows the numbers and percentages of motorcycles found to be speeding by days of the week among those observed per day.

**Table S27: Percentage of motorcycle speeding based on observation session interval, n (%)**

Observation session interval	Number speeding (n=1,822)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Early morning (07:45 - 09:15) (n=12,070)	438 (4)	34 ± 9	34	43
Late morning (10:00 – 11:30) (n=11,141)	344 (3)	32 ± 10	32	41
Afternoon (12:15 - 13:45) (n=10,306)	351 (3)	32 ± 9	32	41
Late Afternoon (14:30 - 16:00) (n=10,444)	324 (3)	33 ± 9	32	41
Evening (16:45 - 18:15) (n=11,522)	365 (3)	32 ± 9	32	41

Table S27 shows that the percentage of motorcycle speeding was similar across different times of the day.

**Table S28: Extent of speeding**

**A) Percentage of motorcycle speeding by extent of speed (using the number of motorcycles that were speeding as the denominator)**

Type of vehicle	>5 km/h	>10 km/h	>15 km/h	>20 km/h
<b>Overall speeding motorcycles (n = 1,822)</b>	666 (37)	229 (13)	99 (5)	33 (2)

Table S28(a) shows that 37% (n=666) of the total number of motorcycles that were speeding (n=1,822) were exceeding the posted speed limit by >5 km/h.

Of note, the number of vehicles speeding > 5km/h includes all motorcycles speeding > 5km/h, > 10 km/h, > 15 km/h and > 20 km/h.

**B) Percentage of speeding by extent of speed (using all motorcycles observed as the denominator)**

Type of vehicle	>5 km/h	>10 km/h	>15 km/h	>20 km/h
<b>All motorcycles observed (n= 55,483)</b>	666 (1)	229 (0)	99 (0)	33 (0)

Table S28 (b) shows that about 1% (n=666) of the total number of motorcycles observed (n= 55,483), were exceeding the posted speed limit by >5 km/h.

**REGRESSION ANALYSIS FOR MOTORCYCLE SPEEDING**

**Table S29: Multivariate logistic regression model based on motorcycle speeding**

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<b>Weather condition</b>		
- Dry/no rain	Ref	Ref
- Light rain/drizzle	0.6 (0.5 – 0.7)	0.5 (0.4 – 0.7)
- Rain	1.0 (0.7 – 1.3)	0.7 (0.5 – 1.0)
<b>Observation session interval</b>		
- Early morning (07:45 - 09:15)	Ref	Ref
- Late morning (10:00 – 11:30)	0.8 (0.7 – 1.0)	0.8 (0.7 – 1.0)
- Afternoon (12:15 - 13:45)	0.9 (0.8 – 1.1)	0.9 (0.8 – 1.1)
- Late Afternoon (14:30 - 16:00)	0.9 (0.7 – 1.0)	0.8 (0.7 – 1.0)
- Evening (16:45 - 18:15)	0.9 (0.8 – 1.0)	0.8 (0.7 – 1.0)
<b>Day of week (weekend/weekday)</b>		
- Weekday	Ref	Ref
- Weekend	1.2 (1.1 – 1.3)	1.2 (1.0 – 1.3)
<b>Road type</b>		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.4 (1.3 – 1.5)	1.1 (1.0 – 1.2)
<b>Level of pedestrian access</b>		
- No access control	Ref	Ref
- Partially controlled	2.7 (2.4 – 3.1)	2.7 (1.3 – 3.1)
<b>Vehicle ownership</b>		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.5 (0.4 – 0.7)	0.5 (0.4 – 0.7)
- Ride-share	0.5 (0.3 – 0.7)	0.5 (0.3 – 0.7)

- Other (private, government, etc.)	1.6 (1.1 – 2.2)	1.6 (1.1 – 2.3)
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Table S28 shows the following:

- Motorcycle speeding was 50% less likely during light rain and 30% less likely during rain compared to dry conditions.
- Motorcycle speeding was about 20% less likely during late morning, late afternoon, and evening compared to early morning.
- Motorcycle speeding is about 20% more likely during weekends compared to weekdays.
- Motorcycles were 10% less likely to speed on arterial roads compared to collector/distributor/local roads.
- Motorcycle speeding was about 2.7 times higher on roads with partially controlled pedestrian access compared to roads freely accessible to pedestrians.
- Taxi and ride-share motorcycles were about 50% less likely to speed compared to commercial motorcycles, while other (both private and government-owned) motorcycles were 1.6 times more likely to speed compared to commercial motorcycles.

## HELMET USE

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

Helmet use	n (Percentage)
<b>Total motorcyclists observed* (N=113,348)</b>	
<b>Overall helmet use<sup>1</sup></b>	50,259 (44)
- Correct helmet use <sup>2</sup>	37,036 (33)
- Incorrect helmet use	12,356 (11)
- Unobservable (Correctness) <sup>3</sup>	867 (1)
<b>No helmet use</b>	63,089 (56)

\*Motorcyclists include drivers and passengers

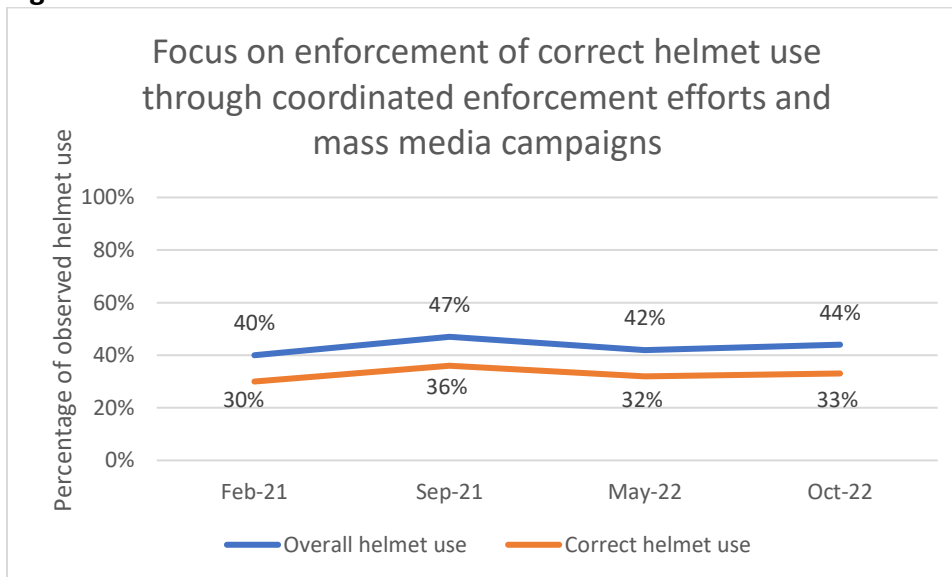
<sup>1</sup>Overall helmet use is defined as strapped or unstrapped use of a helmet of any type.

<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 44% and correct helmet use was 33% among all motorcyclists observed.

**Figure H1: Trends in overall and correct helmet use across rounds 1 to 4 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=75,583)	49,250 (65)	36,226 (48)
Passengers (n=37,765)	1,009 (3)	810 (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=75,583)			Passengers observed (n=37,765)		
	Males (n=74,727; 99%)	Females (n=325; 0%)	Sex unobservable (n=531; 1%)	Males (n=23,416; 62%)	Females (n=13,978; 37%)	Sex unobservable (n=371; 1%)
Overall helmet use	48,634 (65)	243 (75)	373 (70)	820 (4)	181 (1)	8 (2)
Correct helmet use	35,764 (48)	187 (58)	275 (52)	642 (3)	160 (1)	8 (2)

Table H3 shows that correct helmet use was lower among male drivers (48%) compared to female drivers (58%), while correct helmet use was rare among all passengers, irrespective of sex.

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

	Adult passengers observed (n=34,173)			Child passengers observed (n=3,495)		
	Males (n=21,696; 63%)	Females (n=12,423; 36%)	Sex unobservable (n=54; 0%)	Males (n=1,663; 48%)	Females (n=1,520; 43%)	Sex unobservable (n=312; 9%)
Overall helmet use	763 (4)	157 (1)	7 (13)	57 (3)	24 (2)	1 (0)
Correct helmet use	588 (3)	137 (1)	7 (13)	54 (3)	23 (2)	1 (0)

\*Age was not observable for 97 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=73,593)		Weekend (n=39,755)	
	Drivers (n=49,667; 67%)	Passengers (n=23,926; 33%)	Drivers (n=25,916; 65%)	Passengers (n=13,839; 35%)
Overall helmet use	33,338 (67)	793 (3)	15,912 (61)	216 (2)
Correct helmet use	24,576 (49)	636 (3)	11,650 (45)	174 (1)

Table H5 shows that correct helmet use among drivers was slightly higher on weekdays compared to weekends, while 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= 113,348)	Overall Helmet Use (n=50,259)	Correct Helmet Use (n=37,036)
Monday	11,604	5,058 (44)	3,449 (30)
Tuesday	23,311	10,954 (47)	7,942 (34)
Wednesday	24,193	11,224 (46)	8,452 (35)
Thursday	14,485	6,895 (48)	5,369 (37)
Friday*	N/A	N/A	N/A
Saturday	17,541	7,352 (42)	5,428 (31)

Sunday	22,214	8,776 (40)	6,396 (29)
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\*No observations were made on Friday.

Table H6 shows that correct helmet use varied within a range of 29% to 37% 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=75,583) <sup>1</sup>	Overall Helmet Use (n=49,250)	Correct Helmet Use (n=36,226)	N (n=37,765) <sup>2</sup>	Overall Helmet Use (n=1,009)	Correct Helmet Use (n=810)
Early morning (07:45 - 09:15)	15,797	11,343 (72)	8,204 (52)	8,244	174 (2)	133 (2)
Late morning (10:00 - 11:30)	15,044	9,142 (61)	6,639 (44)	6,733	251 (4)	195 (3)
Afternoon (12:15 - 13:45)	13,754	9,333 (68)	7,010 (51)	6,868	139 (2)	108 (2)
Late Afternoon (14:30 - 16:00)	14,582	8,477 (58)	6,109 (42)	6,938	258 (4)	212 (3)
Evening (16:45 - 18:15)	16,406	10,955 (67)	8,264 (50)	8,982	187 (2)	162 (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 42% to 52% 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=113,348)	Overall Helmet Use (n=50,259)	Correct Helmet Use (n=37,036)
Collector/distributor/local roads	83,353	36,841 (44)	26,873 (32)
Arterial roads	29,995	13,418 (48)	10,163 (34)

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

**Table H9: Prevalence of overall and correct helmet use by motorcycle ownership and by type of motorcyclist, n (%)**

Vehicle ownership	Drivers observed			Passengers observed		
	N (n=75,583)	Overall Helmet Use (n=49,250)	Correct Helmet Use (n=36,226)	N (n=37,765)	Overall Helmet Use (n=1,009)	Correct Helmet Use (n=810)
Commercial	1,710	1,047 (61)	837 (49)	319	13 (4)	5 (2)
Taxi	66,661	42,261 (63)	30,233 (45)	34,148	784 (2)	649 (2)
Ride-share	4,790	4,368 (91)	3,906 (82)	2,734	130 (5)	113 (4)

Other (incl private and govt)	2,422	1,574 (65)	1,250 (52)	564	82 (15)	43 (8)
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Table H9 shows that correct helmet use was the highest among drivers of ride-share motorcycles (82%), while passenger helmet use was very low for all motorcycle ownership types (2% to 8%).

## REGRESSION ANALYSIS FOR HELMET USE

Table H10: 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	14.8 (12.3 – 17.8)	1.1 (0.9 – 1.4)
- Unobservable	16.2 (12.4 – 21.2)	1.0 (0.7 – 1.3)
<b>Sex</b>		
- Female	Ref	Ref
- Male	23.7 (21.3 – 26.4)	1.6 (1.4 – 1.9)
- Unobservable	18.4 (15.4 – 21.9)	1.8 (1.5 – 2.2)
<b>Motorcyclist type</b>		
- Driver	Ref	Ref
- Passenger	0.02 (0.02 – 0.03)	0.02 (0.02 – 0.03)
<b>Weather condition</b>		
- Dry/no rain	Ref	Ref
- Light rain/drizzle	0.9 (0.9 – 1.0)	1.1 (1.0 – 1.1)
- Rain	1.6 (1.5 – 1.8)	1.8 (1.6 – 2.0)
<b>Observation session interval</b>		
- Early morning (07:45 - 09:15)	Ref	Ref
- Late morning (10:00 – 11:30)	0.9 (0. – 0.9)	0.8 (0.7 – 0.8)
- Afternoon (12:15 - 13:45)	1.0 (1.0 – 1.0)	0.9 (0.9 – 1.0)
- Late Afternoon (14:30 - 16:00)	0.8 (0.8 – 0.8)	0.7 (0.7 – 0.7)
- Evening (16:45 - 18:15)	0.9 (0.9 – 1.0)	1.0 (0.9 – 1.0)
<b>Day of week</b>		
- Weekday	Ref	Ref
- Weekend	0.8 (0.8 – 0.8)	0.8 (0.8 – 0.9)
<b>Road type</b>		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.1 (1.0 – 1.1)	1.1 (1.1 – 1.2)
<b>Vehicle ownership</b>		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.6 (0.6 – 0.7)	0.9 (0.8 – 0.9)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	1.6 (1.5 – 1.8)	4.1 (3.7 – 4.6)
- Other (private, government, etc.)	1.1 (1.0 – 1.2)	1.2 (1.0 – 1.3)



Table H9 shows the following:

- Correct helmet use was 10% more common among those 18 years or older compared to motorcyclists under 18.
- Correct helmet use was 60% more common among male motorcyclists compared to females.
- Correct helmet use among passengers was rare compared to that among drivers.
- Correct helmet use was 80% more common in rainy weather compared to dry conditions.
- Correct helmet use was low across different times of the day.
- Correct helmet use was 20% less common on weekends compared to weekdays.
- Correct helmet use was 10% more common on arterial roads compared to collector/distributor/local roads.
- Correct helmet use was 4 times more likely among ride-share motorcyclists compared to that of commercial motorcyclists.