

BLOOMBERG PHILANTHROPIES INITIATIVE FOR GLOBAL ROAD SAFETY

KAMPALA ROUND 1

TECHNICAL ANNEX FEBRUARY 2021

SAMPLING METHODOLOGY

The Johns Hopkins International Injury Research Unit partnered with Makerere University to conduct roadside observations in February and March 2021. 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, helmet use, seatbelt and child restraint 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 6:15 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	GPS PRECISION
Kampala	Mbogo road	0.31327	32.5995	1141.07	4.873
Bunga	Kalungu road	0.27722	32.6167	1127.23	4.298
Ggaba bypass	Ggaba bypass next at chop sizzle spice	0.26575	32.6277	1155.65	4.808
Ggaba road	Ggaba road outside the entrance to rahbot brick makers	0.28351	32.61	1152.44	4.853
Kirombe road	Kirombe road at the transformer next to a wooden pole selling place	0.29321	32.5963	1177.5	4.33
Entebbe road	Entebbe road at Pot Plaza	0.28369	32.5677	1187.99	4.839
Namasole	Namasole road	0.28971	32.5802	1215.56	4.288
Bbiina	Bbiina road before radio maria	0.30977	32.6483	1208.19	4.938
Ssembeguya	Dr. Ssembeguya road at unic motel gate	0.37977	32.5634	1215.67	4.639
Ttula	Ttula road	0.37043	32.5691	1199.48	4.985
Bombo	Bombo road	0.37277	32.5575	1195.09	4.61
Busega	Old Mubende	0.31257	32.5168	1153.95	4.263
Busega	Old Mubende road	0.31338	32.5247	1175.79	4.269
Lukuli near harvest investment before the Africa music school building	Lukuli road	0.28095	32.5958	1177.2	4.958

Kampala	Tank hill road just before njuki way	0.29495	32.6138	1243.24	4.727
Kawuku road	Kawuku road about 100 meters past MM flower pot makers moving away from Ggaba bypass	0.26674	32.6308	1144.55	4.288

Helmet Use (Rounds 1-5)

DIVISION	LOCATION	GPS LATITUDE	GPS LONGITUDE	GPS ALTITUDE	GPS PRECISION
Mbogo road	Raised part at the Namuwongo mbogo junction	0.31435	32.5995	1144.44	6.724
Kampala	Tank hill road	0.30009	32.6076	1206.91	4.931
Kampala	Kirombe road opposite interservice hotel	0.29744	32.5953	1187.39	4.824
Kalungu road	Kalungu road junction with Ggaba road	0.27675	32.615	1139.32	4.484
Kawuku road	Kawuku road close to the Ggaba bypass junction	0.26563	32.6289	1151.85	4.581
Ggaba road	Ggaba road at the airtel money booth (along Ggaba road opposite the police booth)	0.29774	32.6006	1177.9	4.99
Namasole road	Namasole road at Pacific car bond. Pacific car bond is just before Uganda local government association	0.2856	32.5688	1179.4	4.916
Entebbe road	Entebbe road are the junction with Kyabagu road	0.27941	32.5662	1206.37	4.628
Biina	Biina road at the junction with Butabika road	0.30954	32.657	1158.89	4.744
Ssembeguya	Dr. Ssembeguya road	0.38121	32.5638	1189.45	4.99
Ttula	Ttula road	0.38149	32.5648	1203.08	4.325
Bombo	Bombo road	0.3753	32.5568	1186.72	4.63
Busega	Old Mubend	0.31159	32.522	1162.05	4.99
Busega	Mugema road	0.31176	32.5258	1203.82	4.922
Busega	Mugema road	0.3077	32.5241	1191.68	4.062
Ggaba bypass	Ggaba bypass at HEM supermarket + pharmacy opposite oryx	0.2659	32.6247	1150.78	4.516
Hanlon road	Hanlon road at the junction with kabega road. Site	0.29851	32.5879	1202.7	4.132

	infront of Uganda martyrs university Nsambya campus gate				
Lukuli opposite Papa's restaurant	Lukuli road	0.28812	32.5849	1212.72	4.873

Seatbelt and child restraint use (Round 1)

DIVISION	LOCATION	GPS LATITUDE	GPS LONGITUDE	GPS ALTITUDE	GPS PRECISION
Mutungo	Biina road near Butabika junction	0.1834	32.3924	1169.09	4.35
Kawempe 1	Bombo road	0.223	32.3324	1200.74	4.85
Kawempe 1	Dr. Sembeguya road	0.2252	32.3349	1192.39	4.93
Najjanankumbi 1	Entebbe road	0.1646	32.3358	1207.01	4.73
Gaba	Ggaba bypass near Oryx	0.1557	32.3729	1155.33	4.9
Kabalagala	Ggaba road near Muyenga hill junction	0.1752	32.362	1179.63	4.04
Kibuye I	Hanlon road near Cardinal Nsubuga junction	0.182	32.3515	1218.32	4.29
Gaba	Kalungu road at Ggaba road junction	0.1636	32.3654	1147.15	4.73
Gaba	Kawuku road at Ggaba bypass junction	0.1556	32.3744	1193.34	4.89
Lukuli	Kirombe road near Interservice hotel	0.175	32.3542	1198.69	4.52
Kabalagala	Mbogo road near 8th street junction	0.1847	32.3558	1168.52	4.42
Busega	Mugema road	0.1842	32.3132	1234.23	4.85
Najjanankumbi 1	Namasole road near Local Government Association	0.178	32.347	1143.05	4.59
Busega	Old Mubende road	0.1841	32.3118	1203.04	3.9
Kabalagala	Tankhill road	0.1759	32.3627	1228.74	4.82
Kawempe 1	Ttula road	0.2252	32.3353	1173.96	4.93

FINDINGS

OVERALL

Number of vehicles and occupants observed for the three risk factors

	Helmet	Seatbelts and Child Restraints	Speed
Vehicles observed	56,173	36,473	60,934
Occupants observed	88,171	57,339	N/A

Number of occupants observed by type

Risk Factors	Number of Observations		
	Driver	Passenger	Total
Helmet	56,149	32,022	88,171
Seatbelt and Child Restraints	36,473	20,866	57,339

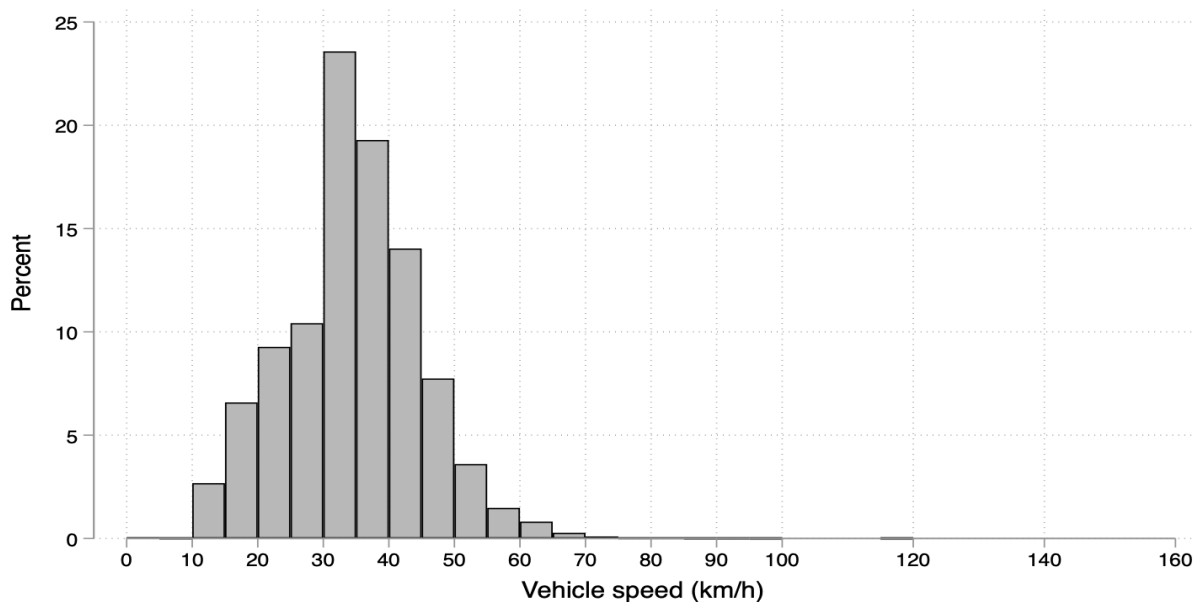
SPEED

Prevalence of speeding

	n (Percentage)	Average Speed (km/h)	Median (km/h)	85th pctl (km/h)
Vehicles observed	60,934	34 ± 10	34	44
Driving above speed limit	3,391 (6)	56 ± 6	54	62
Driving within speed limit	57,543 (94)	33 ± 9	34	42

Posted speed 50 km/h for all road types and vehicles

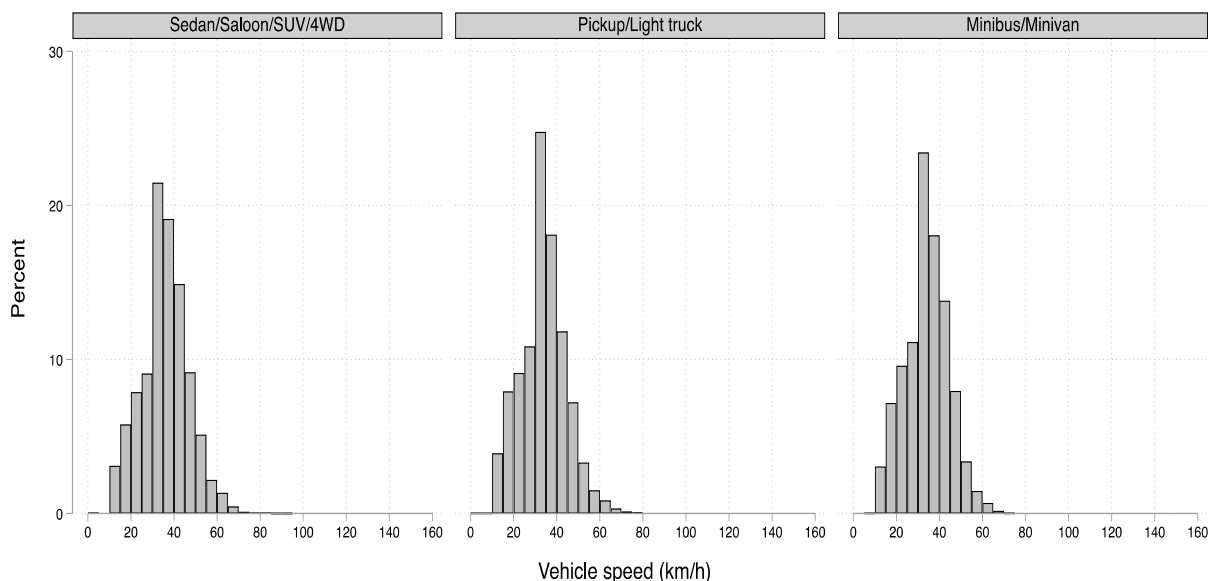
Histogram of speed among all vehicles



Percentage of speeding based on type of vehicle, n (%)

Type of vehicle	Speeding					
	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Pickups/Light trucks	202 (6)	3,427 (94)	3,629	33 ± 11	33	44
Trucks/Large trucks	44 (2)	1,890 (98)	1,934	30 ± 10	31	40
Buses	5 (3)	143 (97)	148	36 ± 9	37	45
Minibuses/Minivans	196 (5)	3,763 (95)	3,959	34 ± 10	34	44
Sedans/Saloons/SUVs/4WDs	1,767 (8)	19,185 (92)	20,952	35 ± 11	35	46
Motorcycles	1,177 (4)	29,128 (96)	30,305	33 ± 10	34	43
Other	0 (0)	7 (100)	7	26 ± 12	23	40

Histogram of speed by top 3 vehicle types with highest prevalence of speeding



Graphs by Top 3 speeding vehicle types

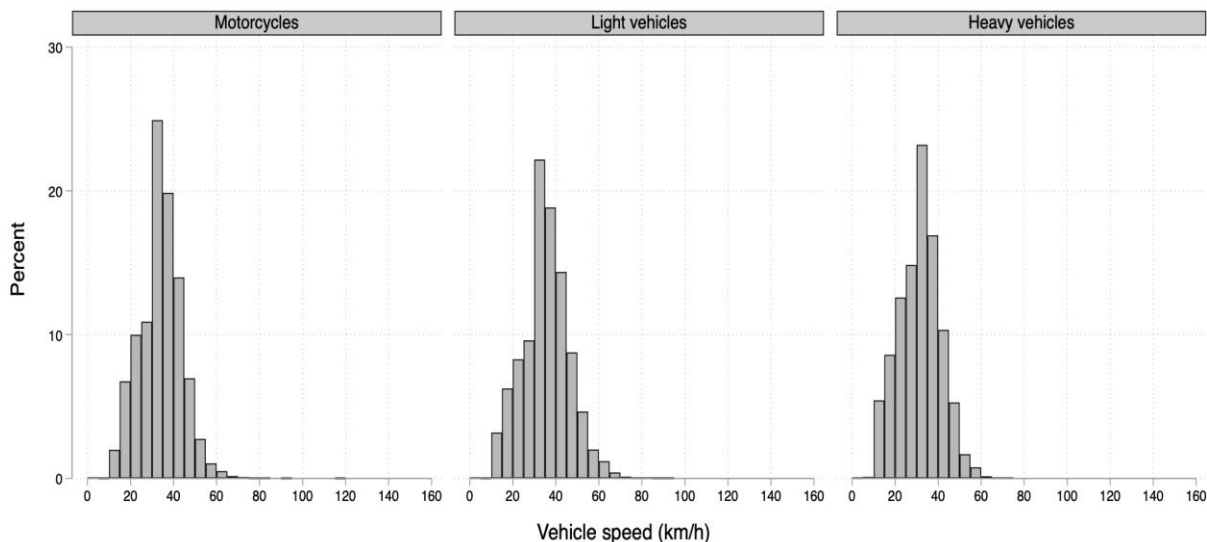
Prevalence of speeding and mean, median, and 85th percentile speed by vehicle

Vehicle type	Prevalence n (%)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Motorcycles (n= 30,305)	1,177 (4)	33 ± 10	34	43
Light vehicles* (n= 28,540)	2,165 (8)	35 ± 11	35	46
Heavy vehicles† (n= 2,082)	49 (2)	31 ± 10	32	41

* Light vehicles include sedans/saloons/SUVs/4WDs, minibuses/minivans, and pickups/light trucks.
† Heavy vehicles include buses and trucks/large trucks.

Note: 7 from "other" are excluded from this analysis, hence the total is 60,927.

Histogram of speed by vehicle type



Graphs by Vehicle type (3 categories)

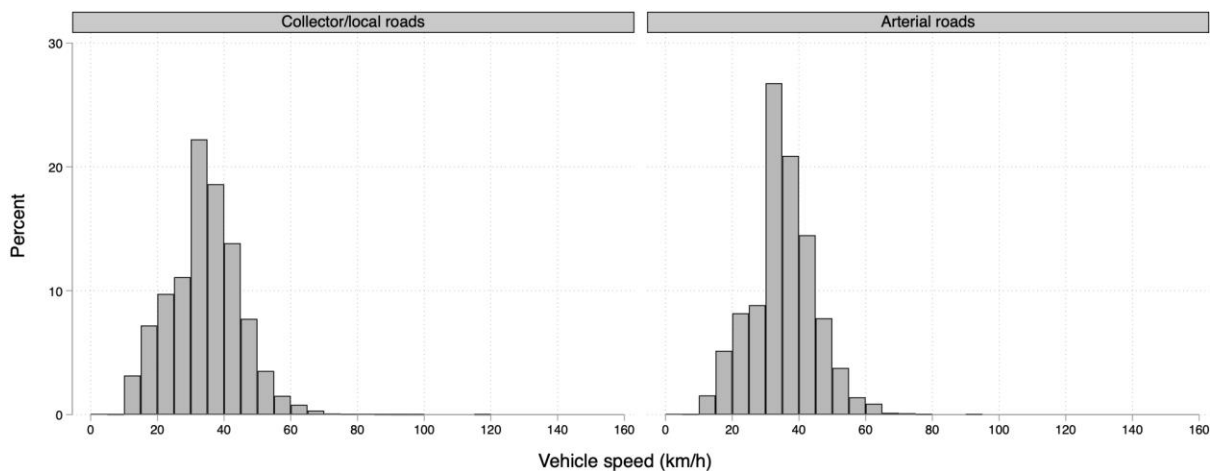
Percentage of speeding based on vehicle ownership, n (%)

Vehicle ownership	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Commercial	129 (2)	5,894 (98)	6,023	29 ± 9	30	39
Taxi	1,423 (5)	25,523 (95)	26,946	35 ± 10	35	44
Ride-share	67 (3)	2,241 (97)	2,308	34 ± 9	35	43
Other (including private and government)	1,772 (7)	23,885 (93)	25,657	34 ± 11	34	45

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

Road type	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Collector/Distributor/Local Road	2,381 (6)	40,325 (94)	42,706	34 ± 11	34	44
Arterial Road	1,010 (6)	17,218 (94)	18,228	35 ± 10	34	44

Histogram of speed by road type



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)	63%
Arterial Road (Speed \geq 50 km/h)	6%

Prevalence of speeding based on pedestrian access, n (%)

Level of pedestrian access	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Media n (km/h)	85 th pctl (km/h)
Fully controlled	0	0	0	N/A	N/A	N/A
Partially controlled	632 (11)	4,956 (89)	5,588	38 \pm 10	37	48
No access control	2,759 (5)	52,587 (95)	55,346	34 \pm 10	34	44

¹Fully controlled roads are those where pedestrians do not have any access to the road. For example, freeways/expressways with the absence of direct access, pedestrian crossing, at-grade intersection, traffic signals. Such roads usually enable high-speed and high-volume travel, including the fact that traffic can flow unhindered by traffic signals, intersections, or property access. Controlled access roads are also free of at-grade crossings with other roads, railroads, or pedestrian paths, which are instead carried by overpasses and underpasses across the highway.

²Partially 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.

Percentage of speeding based on law enforcement, n (%)

Law enforcement	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85 th pctl (km/h)
None	3,382 (6)	57,207 (94)	60,589	34 \pm 10	34	44
Police only	9 (3)	336 (97)	345	37 \pm 7	37	44

Percentage of speeding based on weekday, n (%)

Day	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85 th pctl (km/h)
Weekday	1,858 (5)	35,970 (95)	37,828	33 ± 10	34	44
Weekend	1,533 (7)	21,573 (93)	23,106	35 ± 10	35	45

* The weekend is Saturday and Sunday.

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

Day of the week	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85 th pctl (km/h)
Sunday	636 (5)	11,853 (95)	12,489	35 ± 10	35	44
Monday	527 (6)	8,146 (94)	8,673	34 ± 10	34	44
Tuesday*	N/A	N/A	N/A	N/A	N/A	N/A
Wednesday	275 (3)	8,217 (97)	8,492	30 ± 11	32	41
Thursday	531 (5)	9,389 (95)	9,920	35 ± 10	35	44
Friday	525 (5)	10,218 (95)	10,743	34 ± 10	34	43
Saturday	897 (8)	9,720 (92)	10,617	36 ± 11	36	46

*No observations were made on Tuesday.

Percentage of speeding based on observation session interval

Observation session interval*	Yes (n=3,391)	No (n=57,543)	Total (n=60,934)	Mean (km/h)	Median (km/h)	85 th pctl (km/h)
Early morning (07:45 - 09:15)	703 (6)	11,974 (94)	12,677	33 ± 11	34	44
Late morning (10:00 - 11:30)	616 (5)	12,154 (95)	12,770	34 ± 10	34	44
Afternoon (12:15 - 13:45)	757 (6)	11,022 (94)	11,779	35 ± 10	34	45
Late Afternoon (14:30 - 16:00)	611 (5)	10,667 (95)	11,278	34 ± 10	34	44
Evening (16:45 - 18:15)	704 (6)	11,726 (94)	12,430	34 ± 10	34	44

*The observation session time intervals vary slightly across days of the week. The observational intervals for the majority of observations are used to categorize time differences. Each session last about 90 minutes.

Early morning (07:45 - 09:15) includes observations made between 7:15 – 9:00, 7:30 – 9:10 and 7:45 – 9:15; Late morning (10:00–11:30) includes observations made between 9:45 – 11:30, 10:00-11:00, 10:00-11:30, 10:00- 11:45; Afternoon (12:15-13:45) includes observations made between 12:00-13:45, 12:05- 13:45, 12:15- 13:35 and 12:15 – 13:45; Late Afternoon (14:30-16:00) includes observations made between 14:15- 16:00, 14:30- 16:00; Evening (16:45-18:15) includes observations made between 16:30- 18:15, 16:45- 17:15 and 16:45- 18:15.

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 ¹	>10 km/h	>15 km/h	>20 km/h
Overall speeding vehicles (n = 3,391)	1,342 (40)²	611 (18)	231 (7)	87 (3)
Pickups/Light trucks (n = 202)	87 (43)	41 (20)	16 (8)	6 (3)
Trucks/Large trucks (n = 44)	13 (30)	3 (7)	2 (5)	1 (2)
Buses (n = 5)	0 (0)	0 (0)	0 (0)	0 (0)
Minibuses/Minivans (n = 196)	78 (40)	26 (13)	6 (3)	1 (1)
Sedans/Saloons/SUVs/4WDs (n = 1,767)	729 (41)	345 (20)	132 (8)	49 (3)
Motorcycles (n = 1,177)	435 (37)	196 (17)	75 (6)	30 (3)
Other (n = 0)	0 (0)	0 (0)	0 (0)	0 (0)

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

²40% (n=1,342) of the total number of vehicles that were speeding (n=3,391) were exceeding the posted speed limit by >5 km/h.

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

Type of vehicle	>5 km/h ¹	>10 km/h	>15 km/h	>20 km/h
All vehicles (n = 60,934)	1,342 (2)²	611 (1)	231 (0)	87 (0)
Pickups/Light trucks (n = 3,629)	87 (2)	41 (1)	16 (0)	6 (0)
Trucks/Large trucks (n = 1,934)	13 (1)	3 (0)	2 (0)	1 (0)
Buses (n = 148)	0 (0)	0 (0)	0 (0)	0 (0)
Minibuses/Minivans (n = 3,959)	78 (2)	26 (1)	6 (0)	1 (0)
Sedans/Saloons/SUVs/4WDs (n = 20,952)	729 (3)	345 (2)	132 (1)	49 (0)
Motorcycles (n = 30,305)	435 (1)	196 (1)	75 (0)	30 (0)
Other (n = 7)	0 (0)	0 (0)	0 (0)	0 (0)

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

²2% (n=1,342) of the total number of vehicles observed (n=60,934) 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.

Mean, median, and 85th percentile among vehicles in free flow speed

n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
2,877	56 ± 6	55	62

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	977	56 ± 6	54	62
Light vehicles*	1,860	57 ± 6	55	62
Heavy vehicles†	40	55 ± 4	54	59

* Light vehicles include sedans/saloons/SUVs/4WDs, minibuses/minivans, and pickups/light trucks.

† Heavy vehicles include buses and trucks/large trucks.

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	1,876	57 ± 6	55	62
Arterial	1,001	56 ± 5	54	61

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	2,877	56 ± 6	55	62

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	110	56 ± 5	54	60
Taxi	1,182	56 ± 6	55	62
Ride-share	53	56 ± 5	54	61
Other (incl private and govt)	1,532	56 ± 6	55	62

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	453	56 ± 6	55	61
Tuesday	N/A	N/A	N/A	N/A
Wednesday	173	56 ± 5	54	62
Thursday	391	57 ± 7	55	60
Friday	511	56 ± 6	54	63
Saturday	897	57 ± 6	55	62
Sunday	452	56 ± 5	55	62

Mean, median, and 85th percentile among vehicles in free flow speed by observation session intervals

Observation session interval*	n	Mean (km/h)	Median (km/h)	85th pctl (km/h)
Early morning (07:45 - 09:15)	632	56 ± 5	55	61
Late morning (10:00 - 11:30)	535	56 ± 5	55	61
Afternoon (12:15 - 13:45)	665	57 ± 6	55	62
Late Afternoon (14:30 - 16:00)	468	56 ± 6	54	62
Evening (16:45 - 18:15)	577	56 ± 7	54	62

*The observation session time intervals vary slightly across days of the week. The observational intervals for the majority of observations are used to categorize time differences. Each session last about 90 minutes.

Early morning (07:45 - 09:15) includes observations made between 7:30 - 9:15 and 7:45 - 9:15; Late morning (10:00-11:30) includes observations made between 9:45 - 11:30, 10:00-11:00, 10-11:30, 10:00- 11:45; Afternoon

(12:15-13:45) includes observations made between 12:00-13:45, 12:05- 13:45, 12:15- 13:35 and 12:15 – 13:45; Late Afternoon (14:30-16:00) includes observations made between 14:15- 16:00, 14:30- 16:00; Evening (16:45-18:15) includes observations made between 16:30- 18:15, 16:45- 17:15 and 16:45- 18:15.

REGRESSION ANALYSIS FOR SPEED

Multivariate logistic regression model based on speeding

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Weather condition		
- Dry/no rain	Ref	Ref
- Light rain/drizzle	1.3 (0.9 – 1.7)	2.2 (1.6 – 2.9)
- Rain	0.9 (0.7 – 1.1)	1.0 (0.8 – 1.4)
Observation session interval		
- Early morning (07:15 - 09:00)	Ref	Ref
- Late morning (9:45 – 11:30)	0.9 (0.8 – 1.0)	0.8 (0.8 – 0.9)
- Afternoon (12:15 - 14:00)	1.2 (1.1 – 1.3)	1.1 (1.0 – 1.2)
- Late afternoon (14:45 - 16:30)	1.0 (0.9 – 1.1)	0.9 (0.8 – 1.0)
- Evening (17:15 - 19:00)	1.0 (0.9 – 1.1)	0.9 (0.8 – 1.0)
Day of week		
- Weekday	Ref	Ref
- Weekend	1.4 (1.3 – 1.5)	1.3 (1.3 – 1.4)
Road type		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.0 (0.9 – 1.1)	0.5 (0.5 – 0.6)
Law enforcement		
- None	Ref	Ref
- Police only	0.5 (0.2 – 0.9)	0.9 (0.5 – 1.8)
Level of pedestrian access		
- No access control	Ref	Ref
- Partially controlled	2.4 (2.2 -2.7)	4.1 (3.6 – 4.8)
Vehicle type		
- Pickups/Light trucks	Ref	Ref
- Trucks/Large trucks	0.4 (0.3 – 0.5)	0.5 (0.4 - 0.7)
- Buses	0.6 (0.2 – 1.5)	0.7 (0.3 – 1.9)
- Minibuses/Minivans	0.9 (0.7 – 1.1)	0.5 (0.4 – 0.6)
- Sedans/Saloons/SUVs/4WDs	1.6 (1.3 – 1.8)	1.3 (1.1 – 1.5)
- Motorcycles	0.7 (0.6 – 0.8)	0.4 (0.4 – 0.5)
Vehicle ownership		
- Commercial (with company logo)	Ref	Ref
- Taxi	2.5 (2.1 – 3.1)	3.1 (2.6 - 3.8)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	1.4 (1.0 – 2.0)	1.8 (1.3 - 2.5)
- Other (private, government, etc.)	3.4 (2.8 – 4.1)	1.9 (1.5 – 2.3)

HELMET USE

Percentage of helmet use among motorcycle occupants

Helmet use	n (Percentage)
Total occupants observed*	88,171 (100)
Overall helmet use¹	35,041 (40)
- Correct helmet use ²	26,083 (30)
- Incorrect helmet use	8,591 (10)
- Unobservable (Correctness) ³	367 (0)
No helmet use	53,130 (60)

*Occupants include drivers and passengers

¹Overall helmet use is defined as strapped or unstrapped use of a helmet of any type.

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

³Correct helmet use is unobservable when helmet use, strap use, or helmet type is unobservable.

Percentage of helmet use by type of motorcycle occupants

Helmet use by occupant type	n (Percentage)
Total occupants observed	88,171
- Drivers observed (n=56,149)	N/A
- Passengers observed (n=32,022)	
Helmet use among occupants observed	
- Drivers	34,523 (62)
- Passengers	518 (2)
Correct helmet use among occupants observed	
- Drivers	25,678 (46)
- Passengers	405 (1)

Percentage of helmet use by type of motorcycle occupants and sex, n (%)

	Drivers observed (n=56,149)			Passengers observed (n=32,022)		
	Males (n=55,644; 99%)	Females (n=294; 1%)	Sex unobservable (n=211; 0%)	Males (n=18,431; 58%)	Females (n=13,270; 41%)	Sex unobservable (n=321; 1%)
Overall helmet use	34,223 (62)	152 (52)	148 (70)	385 (2)	132 (1)	1 (0)
Correct helmet use	25,457 (46)	114 (39)	107 (51)	283 (2)	121 (1)	1 (0)

- About 99% of motorcycle drivers are male; about 58% of passengers are male while 41% of passengers are female.
- Overall and correct helmet use are more common among male drivers compared to that of female drivers.

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

	Adult passengers observed (n=29,363)			Child passengers observed (n=2,558)		
	Male (n=17,221; 59%)	Female (n=12,098; 41%)	Sex unobservable (n=44; 0%)	Male (n=1,157; 45%)	Female (n=1,125; 44%)	Sex unobservable (n=276; 11%)
Overall helmet use	363 (2)	129 (1)	1 (2)	18 (2)	1 (0)	0 (0)
Correct helmet use	267 (2)	118 (1)	1 (2)	14 (1)	1 (0)	0 (0)

*Age was not observable for 101 passengers

Percentage of helmet use by motorcycle occupants and day of the week, n (%)

	Weekday (n=55,307)		Weekend (n=32,864)	
	Drivers (n=35,396; 64%)	Passengers (n=19,911, 36%)	Drivers (n=20,753, 63%)	Passengers (n=12,111, 37%)
Overall helmet use	22,444 (63)	386 (2)	12,079 (58)	132 (1)
Correct helmet use	16,497 (47)	302 (2)	9,181 (44)	103 (1)

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

Day of week	N (n= 88,171)	Overall Helmet Use (n=35,041)	Correct Helmet Use (n=26,083)
Monday	13,992	5,896 (42)	4,369 (31)
Tuesday*	N/A	N/A	N/A
Wednesday	16,347	6,929 (42)	4,953 (30)
Thursday	12,909	5,364 (42)	3,974 (31)
Friday	12,059	4,641 (39)	3,503 (29)
Saturday	16,444	6,735 (41)	4,985 (30)
Sunday	16,420	5,476 (33)	4,299 (26)

*No observations were made on Tuesday

Helmet use by motorcycle occupants based on observation session interval, n (%)

Observation session interval*	Drivers observed			Passengers observed		
	N (n=56,149) ¹	Overall Helmet Use (n=34,523)	Correct Helmet Use (n=25,678)	N (n=32,022) ²	Overall Helmet Use (n=518)	Correct Helmet Use (n=405)
Early morning (07:45 - 09:15)	11,840	7,807 (66)	5,726 (48)	6,369	110 (2)	90 (1)
Late morning (10:00 – 11:30)	11,413	6,884 (60)	5,056 (44)	6,215	98 (2)	79 (1)
Afternoon (12:15 – 13:45)	11,160	6,752 (61)	5,041 (45)	6,385	106 (2)	80 (1)
Late Afternoon (14:30 - 16:00)	10,573	6,292 (60)	4,770 (45)	6,201	82 (1)	61 (1)
Evening (16:45 - 18:15)	11,163	6,788 (61)	5,085 (46)	6,852	122 (2)	95 (1)

¹ indicates the total number of drivers observed

² indicates the total number of passengers observed

* The observation session time intervals vary slightly across days of the week. The observational intervals for the majority observations are used to categorize time differences. Each session lasted about 90 minutes.

Early morning (7:45-9:15) includes observations made between 7:45 – 9:15, 8:00-9:30, and 7:45-9:45; Late morning (10:00–11:30) includes observations made between 9:45 – 11:30; Afternoon (12:15-13:45) includes observations made between 12:15 – 13:45; Late Afternoon (15:30-16:00) includes observations made between 14:30- 16:00 and 14:30-16:30; Evening (16:45 - 18:15) includes observations made between 16:30 - 18:15 and 16:45 - 18:15.

Prevalence of overall and correct helmet use by road type, n (%)

Road type	N (n=88,171)	Overall Helmet Use (n=35,041)	Correct Helmet Use (n=26,083)
Collector/distributor/local roads	62,706	25,444 (41)	18,578 (30)
Arterial roads	25,465	9,597 (38)	7,505 (30)

Prevalence of overall and correct helmet use based on law enforcement and type of occupant, n (%)

Law enforcement type	Drivers observed			Passengers observed		
	N (n=56,149)	Overall Helmet Use (n=34,523)	Correct Helmet Use (n=25,678)	N (n=32,022)	Overall Helmet Use (n=1,359)	Correct Helmet Use (n=1,178)
None	51,933	31,904 (61)	23,578 (45)	29,940	479 (2)	377 (1)
Police only	4,216	2,619 (62)	2,100 (50)	2,082	39 (2)	28 (1)

Prevalence of overall and correct helmet use by vehicle ownership and by type of occupant, n (%)

Vehicle ownership	Drivers observed			Passengers observed		
	N (n=56,149)	Overall Helmet Use (n=34,523)	Correct Helmet Use (n=25,678)	N (n=32,022)	Overall Helmet Use (n=518)	Correct Helmet Use (n=405)
Commercial	6,813	3,761 (55)	3,333 (49)	3,397	68 (2)	51 (2)
Taxi	41,188	23,953 (58)	16,666 (41)	24,612	300 (1)	248 (1)
Ride-share	5,436	5,078 (93)	4,284 (79)	3,346	77 (2)	64 (2)
Other (incl private and govt)	2,712	1,731 (64)	1,395 (51)	667	73 (11)	42 (6)

*Private, government, etc.

REGRESSION ANALYSIS FOR HELMET USE

Multivariate logistic regression model for correct helmet use

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age		
- Under 18 years	Ref	Ref
- 18 years and older	29.2 (21.3 – 39.6)	3.1 (2.2 – 4.4)
- Unobservable	30.5 (20.6 – 45.2)	3.0 (1.9 – 4.6)
Sex		
- Female	Ref	Ref
- Male	30.2 (26.5 – 34.4)	1.6 (1.3 – 1.9)
- Unobservable	14.4 (11.3 – 18.5)	1.8 (1.3 – 2.5)
Occupant type		
- Driver	Ref	Ref
- Passenger	0.0 (0.0 – 0.0)	0.0 (0.0 – 0.0)
Weather condition		
- Dry/no rain	Ref	Ref
- Light rain/drizzle	1.0 (1.0 – 1.1)	1.0 (0.9 – 1.1)
- Fog	1.2 (1.1 – 1.3)	1.0 (0.9 – 1.1)
- Other	0.9 (0.7 – 1.2)	1.0 (0.7 – 1.3)
Observation session interval		
- Early morning	Ref	Ref
- Late morning	0.9 (0.8 – 0.9)	0.8 (0.8 - 0.9)
- Afternoon	0.9 (0.8 – 0.9)	0.9 (0.8 – 0.9)
- Late Afternoon	0.9 (0.8 – 0.9)	0.9 (0.8 – 0.9)
- Evening	0.9 (0.8 – 0.9)	0.9 (0.8 – 0.9)
Day of week		
- Weekday	Ref	Ref
- Weekend	0.9 (0.9 – 0.9)	0.9 (0.9 - 0.9)
Road type		
- Collector/Distributor/Local roads	Ref	Ref
- Arterial roads	1.0 (1.0 – 1.0)	1.0 (0.9 – 1.0)
Law enforcement		

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
- None	Ref	Ref
- Police only	1.1 (1.0 – 1.2)	1.2 (1.0 – 1.3)
- Camera only	1.0 (1.0 – 1.1)	1.0 (1.0 – 1.1)
- Police and camera	1.3 (1.2 – 1.4)	1.2 (1.1 – 1.3)
Vehicle ownership		
- Commercial (with company logo)	Ref	Ref
- Taxi	0.7 (0.7 – 0.7)	0.7 (0.7 – 0.8)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	2.0 (1.9 – 2.1)	3.7 (3.4 – 4.0)
- Other (private, government, etc.)	1.5 (1.4 – 1.6)	1.2 (1.1 – 1.3)

SEAT-BELTS AND CHILD RESTRAINT USE

The percentage of seatbelt and child restraints use

	n (Percentage)
Total vehicles observed (N=36,473)	N/A
Total occupants observed (N=57,339)	N/A
Overall Seatbelt use 12 years and older (n=55,790)	22,947 (41)
- Drivers (n=36,473)	19,341 (53)
o Adult drivers (n=36,295)	19,331 (53)
o Non-adult drivers (n=11)	6 (55)
o Age unobservable (n=167)	4 (2)
- Passengers (n=19,317)	3,606 (19)
o Front seat (n=15,579)	3,382 (22)
o Rear seat (n=3,738)	224 (6)
- Adult passengers (≥ 18 years) (n=18,676)	3,459 (19)
- Child passengers (≥12 and <18 years) (n=641)	147 (23)
Overall Child restraint use under 12 years (n=1,549)	19 (1)
- Under 5 years (n=554)	16 (3)
- Between 5-11 years (n=995)	3 (0)

Percentage of seatbelt and child restraint use among passengers by age and seating positions

	n (Percentage)
Seatbelt use among adult passengers (>18 years) (n=18,676)	3,459 (19)
- Front seat (n=15,228)	3,256 (21)
- Rear seat (n=3,448)	203 (6)
Seatbelt use among child passengers (≥12 and <18 years) (n=641)	147 (23)
- Front seat (n=351)	126 (36)
- Rear seat (n=290)	21 (7)
Child restraint use among child passengers (<12 years) (n=1,549)	19 (1)
- Front seat (n=832)	7 (1)
- Rear seat (n=717)	12 (2)
Child restraint use among child passengers (≥5 and <12 years) (n=995)	3 (0)
- Front seat (n=481)	3 (1)
- Rear seat (n=514)	0 (0)
Child restraint use among child passengers (<5 years) (n=554)	16 (3)
- Front seat (n=351)	4 (1)
- Rear seat (n=203)	12 (6)

Percentage of seatbelt and child restraint use based on type of occupant, age, and sex

	n (Percentage)
Seatbelt use among drivers (n=36,473)	19,341 (53)
- Male (n=30,877)	15,333 (50)
- Female (n=5,375)	3,975 (74)
- Sex non-observable (n=221)	33 (15)
Seatbelt use among adult passengers (>18 years) (n=18,676)	3,459 (19)
- Males (n=12,088)	1,768 (15)
- Females (n=6,543)	1,688 (26)
- Sex non-observable (n=45)	3 (7)
Seatbelt use among child passengers (≥12 and <18 years) (n=641)	147 (23)
- Males (n=308)	81 (26)
- Females (n=316)	65 (21)
- Sex non-observable (n=17)	1 (6)
Child restraint use among child passengers (<12 years) (n=1,549)	19 (1)
- Males (n=623)	3 (1)
- Females (n=622)	4 (1)
- Sex non-observable (n=304)	12 (4)
Child restraint use among child passengers (<5 years) (n=554)	16 (3)
- Males (n=174)	1 (1)
- Females (n=191)	3 (2)
- Sex non-observable (n=189)	12 (6)
Child restraint use among child passengers (5-11 years) (n=995)	3 (0)
- Males (n=449)	2 (1)
- Females (n=431)	1 (0)
- Sex non-observable (n=115)	0 (0)

Number of vehicles and occupants observed by type of vehicle

Type of Vehicle	Number of vehicles observed (N=36,473)	Number of occupants observed (N=55,790)	Number of drivers observed (n=36,473)	Number of Passengers observed (n=19,317)
Pickups/light trucks	4,226 (12)	7,094	4,226	2,868
Trucks/large trucks	2,218 (6)	4,166	2,218	1,948
Buses	120 (0)	120	120	0
Minibuses/minivans	3,959 (11)	7,217	3,959	3,258
Sedans/saloons/SUVs/4WDs	25,937 (71)	37,169	25,937	11,232
Other	13 (0)	24	13	11

Percentage of seatbelt use by vehicle type and occupant type*

Type of vehicle	Drivers (n=36,473)		Passengers (n=19,317)	
	Yes (n=19,341)	No (n=16,833)	Yes (n=3,606)	No (n=15,283)
Pickups/light trucks	1,705 (40)	2,486 (59)	267 (9)	2,559 (89)
Trucks/large trucks	748 (34)	1,456 (66)	77 (4)	1,862 (96)
Buses	61 (51)	58 (48)	N/A	N/A
Minibuses/minivans	771 (19)	3,174 (80)	141 (4)	3,105 (95)
Sedans/saloons/SUVs/4WDs	16,055 (62)	9,648 (37)	3,120 (28)	7,747 (69)
Other	1 (8)	11 (85)	1 (9)	10 (91)

The percentages in the table above are calculated using denominators (number of drivers and passengers observed per vehicle type) listed in the table for number of vehicles and occupants (>12 years old) observed by type of vehicle. For example, of those drivers driving pickup/light truck (n=4,226), 40% percent were using seatbelts and 59% were not using seatbelts.

The numbers of occupants in the table above only include occupants who are ≥12 years old.

Prevalence of seatbelt use by road type, n (%)

Road type	Yes (n=22,947)	No (n=32,116)	Unobservable (%) (n=727)
Collector/Distributor/Local Roads (n=40,222)	17,496 (44)	22,168 (55)	558 (1)
Arterial Roads (n=15,568)	5,451 (35)	9,948 (64)	169 (1)

Prevalence of seatbelt use by vehicle ownership, n (%)

Vehicle ownership type	Yes (n=22,947)	No (n= 32,116)	Unobservable (%) (n=727)
Commercial (n=4,801)	1,351 (28)	3,401 (71)	49 (1)
Taxi (n=13,471)	4,929 (37)	8,469 (63)	73 (1)
Ride-share (n=211)	100 (47)	104 (49)	7 (3)
Other (incl private and govt) (n=37,307)	16,567 (44)	20,142 (54)	598 (2)

Prevalence of seatbelt use by day of the week, n (%)

Day of the week	Yes (n=22,947)	No (n=32,116)	Unobservable (%) (n=727)
Weekday (n= 36,919)	15,189 (41)	21,179 (57)	551 (1)
Weekend (n=18,871)	7,758 (41)	10,937 (58)	176 (1)

Prevalence of seatbelt use by observation session interval

Observation session interval	Yes (n=22,947)	No (n=32,116)	Unobservable (%) (n=727)
Early morning 07:45 - 09:15 (n=10,444)	4,341 (42)	5,964 (57)	139 (1)
Late morning 10:00 - 11:30 (n=11,129)	4,638 (42)	6,325 (57)	166 (1)
Afternoon 12:15 - 13:45 (n=10,952)	4,519 (41)	6,312 (58)	121 (1)
Late Afternoon 15:30 - 16:00 (n=11,229)	4,437 (40)	6,648 (59)	144 (1)
Evening 16:45 - 18:15 (n=12,036)	5,012 (42)	6,867 (57)	157 (1)

* The observation session time intervals vary slightly across days of the week. The observational intervals for the majority of observations are used to categorize time differences. Each session last about 90 minutes. Early morning (7:45-9:15) includes observations made between 7:15-9:15 and 7:45 – 9:15; Late morning (10:00–11:30) includes observations made between 9:45 – 11:30, 10:00-11:30, and 9:45 – 10:38; Afternoon (12:15-13:45) includes observations made between 12:00-13:30, 11:30-13:45, 12:00-13:45, 12:15 – 13:45, and 12:15 – 14:00; Late Afternoon (15:30-16:00) includes observations made between 14:15- 16:00 and 14:30-16:00; Evening (16:45 -18:15) includes observations made between 16:30 - 18:15 and 16:45 - 18:15.

REGRESSION ANALYSIS FOR SEATBELT USE

Multivariable logistic regression model based on seatbelt use

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age		
- Under 18 years	Ref	Ref
- 18 years and older	2.3 (1.9 – 2.7)	1.0 (0.8 – 1.2)
- Unobservable	2.1 (0.6 – 7.5)	0.5 (0.1 – 2.1)
Sex		
- Female	Ref	Ref
- Male	0.7 (0.7 – 0.8)	0.5 (0.5 – 0.6)
- Unobservable	0.6 (0.4 – 1.0)	0.5 (0.3 – 0.8)
Occupant type		
- Driver	Ref	Ref
- Passenger	0.2 (0.2 – 0.2)	0.2 (0.2 – 0.2)
Observation session interval		
- Early morning	Ref	Ref
- Late morning	1.0 (1.0 – 1.1)	1.0 (1.0 – 1.1)
- Afternoon	1.0 (0.9 – 1.0)	1.0 (0.9 – 1.0)
- Late afternoon	0.9 (0.9 – 1.0)	0.9 (0.8 – 0.9)
- Evening	1.0 (1.0 – 1.1)	1.0 (0.9 – 1.0)

Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Day of week		
- Weekday	Ref	Ref
- Weekend	1.0 (1.0 – 1.0)	1.0 (0.9 – 1.0)
Road type		
- Collector/ Distributor/Local Road	Ref	Ref
- Arterial Road	0.7 (0.7-0.7)	0.8 (0.7 – 0.8)
Law enforcement		
- None	Ref	Ref
- Police only	0.5 (0.4 – 0.7)	0.5 (0.4 – 0.7)
- Camera only	1.5 (1.5 – 1.6)	1.4 (1.3 – 1.4)
- Both police and camera	1.8 (1.7 – 1.9)	2.0 (1.8 – 2.1)
Vehicle type		
- Pickups/Light trucks	Ref	Ref
- Trucks/Large trucks	0.6 (0.6 – 0.7)	0.7 (0.6 – 0.7)
- Buses	2.7 (1.9 – 3.9)	1.8 (1.2 – 2.6)
- Minibuses/Minivans	0.4 (0.3 – 0.4)	0.4 (0.4 – 0.4)
- Sedans/Saloons/SUVs/4WDs	2.8 (2.7 – 3.0)	2.5 (2.3 – 2.7)
- Other	0.4 (0.1 – 1.0)	0.3 (0.1 – 1.1)
Vehicle ownership		
- Commercial (with company logo)	Ref	Ref
- Taxi	1.5 (1.4 – 1.6)	0.8 (0.7 – 0.8)
- Ride-share (with company sticker of Grab, Lyft, Uber, etc.)	2.4 (1.8 – 3.2)	1.4 (1.0 – 1.9)
- Other (private, government, etc.)	2.1 (1.9 – 2.2)	0.8 (0.7 – 0.9)