

Social Media Video Footage Analysis of Car-to-Motorcycle Accidents in Indonesia

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ABSTRACT – This study investigates car-to-motorcycle accidents in Indonesia by analyzing social media video footage to provide real-world insights into accident dynamics. With motorcycles accounting for a significant portion of traffic accidents in Indonesia, this research aims to identify the key factors contributing to such accidents, including road and environmental conditions, impact scenarios, and injury types. The systematic analysis using a video observation checklist reveals that suburban (46%) and rural areas (35%) are the primary locations where accidents occurred, with straight roads being the most common accident location (57%). Environmental factors such as clear weather and daylight conditions were prevalent in the majority of incidents. The study also identifies frontal collisions as the most common impact type (49%), leading to significant upper body (48%) and leg (34%) injuries for motorcyclists. In terms of vehicle types, Multi-Purpose Vehicles (MPVs) were the most common car type involved (72%), while motorcycles were predominantly bikes (90%) rather than scooters or superbikes. The study also highlights the dominance of Honda motorcycles (64%) in these accidents, reflecting their widespread use in Indonesia. The findings contribute to the development of motorcyclist safety technologies, including the Autonomous Emergency Braking Motorcycle System (AEB MS), by providing empirical data on accident scenarios. The research highlights the importance of region-specific safety protocols for improving road safety and reducing fatalities among vulnerable road users in Southeast Asia.

KEYWORDS: Road safety, vulnerable road user, car-to-motorcycle accident, video footage analysis, ASEAN NCAP, Autonomous Emergency Braking Motorcycle System (AEB MS)

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1. INTRODUCTION

Road traffic accidents remain one of the most pressing public health and safety concerns worldwide, with vulnerable road users (VRUs) – including pedestrians, cyclists, and motorcyclists – facing the highest levels of risk. According to global statistics, motorcyclists alone account for 28% of all road traffic fatalities, while pedestrians and cyclists represent an additional 26%. In Southeast Asia, where motorcycles dominate the transport system, this issue is particularly critical (ASEAN NCAP, 2023). As the most populous country in the region, Indonesia – where motorcycles dominate daily transportation – provides a highly relevant context for studying car-to-motorcycle accidents. In Indonesia, motorcycles account for a substantial proportion of the total vehicles on the road. Recent overviews also highlight Indonesia's specific crash patterns and discuss the applicability of blind-spot detection for reducing car-motorcycle conflicts (Zadry et al., 2022). According to the National Traffic Police Corps (PUSIKNAS POLRI, 2025), there were over 117,000 traffic accidents in Indonesia in 2022, with motorcycles involved in approximately 70% of these incidents. The accidents resulted in more than 26,000 fatalities and around 124,000 injuries, highlighting the severity of the issue (Badan Pusat Statistik, 2024).

Recognizing this challenge, the New Car Assessment Program for Southeast Asian Countries (ASEAN NCAP) has introduced the Motorcyclist Safety Pillar in its 2021–2025 Roadmap (ASEAN NCAP, 2018). This initiative calls upon the automotive industry to adopt advanced technologies and safety systems to reduce motorcyclist fatalities, with plans to implement the Autonomous Emergency Braking Motorcycle System (AEB MS) as part of the safety framework beginning in 2026.

Despite these efforts, a major obstacle remains: the lack of comprehensive real-world crash data on car-to-motorcycle accidents in ASEAN countries, especially Indonesia. A deeper understanding of accident dynamics is vital to inform evidence-based policies and the development of safety technologies that can effectively address the unique risks faced by motorcyclists. In this context, video-based accident analysis has emerged as a valuable tool (Ariffin et al., 2025). Unlike human testimony, which can be influenced by memory and perception biases, dashcams and other video recordings provide impartial, time-stamped evidence of crash events (Rea et al., 2018; Jawi et al., 2022). Our previous projects, such as ANCHOR IV, have already demonstrated the usefulness of dashcam footage in reconstructing collisions, particularly those involving motorcycles in vehicle blind spots.

Building on these findings, this study collects and analyzes real-world video footage of car-to-motorcycle accidents in Indonesia. By examining road and environmental conditions, impact conditions, injury patterns, and vehicle types, this research seeks to identify the main accident scenarios that contribute to such crashes. The results will not only support accident investigation and road safety improvements but also provide empirical insights to guide the introduction of motorcyclist-focused safety technologies – including the upcoming AEB MS – into the future ASEAN NCAP Protocol 2031–2035. The objective of this research is therefore twofold: (1) to provide a detailed categorization of accident scenarios involving cars and motorcycles in Indonesia, and (2) to contribute data-driven evidence that supports regional and global initiatives aimed at protecting vulnerable road users.

2. METHODOLOGY

This study employs a quantitative observation approach. This method was applied to video footage of car-to-motorcycle accidents uploaded to various social media platforms (Ariffin et al., 2021; Sukadarin et al., 2023). This approach aims to provide a detailed categorization of accident scenarios involving cars and motorcycles in Indonesia, and to contribute data-driven evidence that supports regional and global initiatives aimed at protecting vulnerable road users.

2.1 Research Population and Sample

The research population consisted of car-to-motorcycle accident video footage available on social media platforms (Instagram, TikTok, YouTube, Snack Video, Facebook). A total of 100 car-to-motorcycle accident videos were selected as samples using purposive sampling based on the following inclusion criteria: real incidents in Indonesia, a minimum duration of 10 seconds, clear point of view, and sufficient visual quality for analysis.

2.2 Research Instruments

A video observation checklist was used to record key variables from each video, including weather and lighting conditions, road category and intersection type, impact conditions, injury type, and vehicle type.

2.3 Data Collection Techniques

Accident video footage was collected from social media platforms (Instagram, TikTok, YouTube, Snack Video, and Facebook) and analyzed using a structured checklist.

2.4 Data Analysis Techniques

Data from video observations were numerically coded and then entered into the video observation checklist for further analysis. Descriptive analysis was conducted to map the frequency and distribution of research variables.

2.5 Research Variables

The research variables from video observations were organized into road condition, environmental condition, impact condition, injury condition, and vehicle type (Widia et al., 2021a, 2021b; Sukadarin et al., 2023). The categories of each variable are shown in Table 1.

TABLE 1: Research variables

Road Condition	
Road Category	highway, suburban, rural, urban
Road Intersection (Figure 1)	T-junction, 4-junction, straight, curve, U-turn
Environmental Condition	
Weather Condition	Rain, fine/clear, fog
Light Condition	Daylight, dust or dawn, night without streetlights
Impact Condition	
Colliding Area (Figure 2)	Approaching a stationary motorcycle, approaching a braking motorcycle, turning across the path of an oncoming motorcycle, changing lane across the path of an oncoming motorcycle, changing lane across the path of an overtaking motorcycle, others.
Car Maneuver Before Crash	Moving in a straight line, turning right, turning left, passing maneuver (right)
Motorcycle Maneuver Before Crash	Moving in a straight line, turning right, turning left, passing maneuver (right)
Motorcycle Body Impact	Right side, left side, front, rear
Injuries Condition	
First Body Impact (Figure 3)	Head impact, upper body impact, pelvis impact, leg impact, others
Driver Injury	Injured, not injured, dead
Rider Injury	Injured, not injured, dead
Passenger Injury	Injured, not injured, dead
Helmet Use	Yes, no, other
Vehicle Type	
Car Type	SUV, car, MPV, other
Car Brand Type	Honda, Perodua, Proton, Toyota, Nissan, others
Motorcycle Type	Scooter, bike, superbike
Motorcycle Brand Type	Yamaha, Honda, Kawasaki, Modenas, Suzuki, others

To provide a clearer understanding of the road intersection, collision area, and first body impact categories, Figures 1, 2, and 3 present the corresponding illustrations.

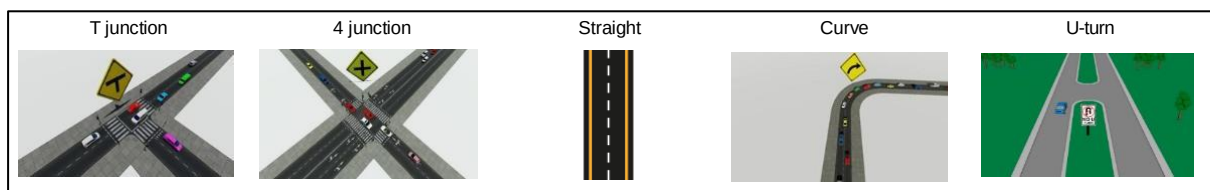


FIGURE 1: Road Intersection

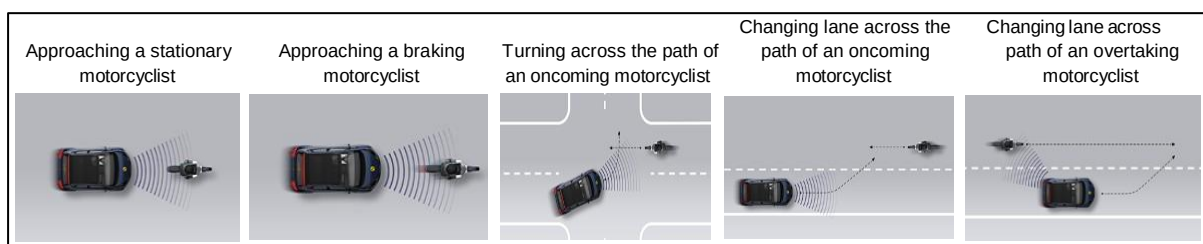


FIGURE 2: Collision area



FIGURE 3: First body impact

2.6 Research Ethics

This study ensures the confidentiality and anonymity of the data in accordance with human research ethics standards. The information obtained is used solely for academic and scientific purposes.

2.7 Research Steps

The research steps are as follows:

- Collection of car-to-motorcycle accident video footage from social media according to the inclusion criteria.
- Preparation of an observation checklist based on key variables from the literature and research objectives.
- Video analysis by recording and classifying accident patterns and rider behaviour.
- Interpretation of results and development of recommendations for the implementation of active safety technologies based on identified accident patterns.

3. RESULTS AND DISCUSSION

3.1 Road Condition

Table 2 shows the road condition of car-to-motorcycle accidents.

TABLE 2: Road condition

Road Condition	Percentage (%)
Road Category	
Highway	2
Suburban	46
Rural	35
Urban	17
Road Intersection	
T-junction	19
4-junction	12
Straight	57
Curve	4
U-turn	8

The data in Table 2 shows a majority of car-to-motorcycle accidents occurring in suburban (46%) and rural (35%) areas. This suggests that these environments may be particularly hazardous due to factors such as insufficient infrastructure or reduced road maintenance. Straight roads were the most common road type involved in accidents (57%), which could be attributed to drivers' overconfidence or the absence of obvious hazards. The high number of crashes on straight roads also suggests that factors such as speeding or inattention may have been involved. While urban areas account for 17% of accidents, the presence of more vehicles and higher traffic volumes likely contribute to this, though it is less than in suburban or rural settings. Poor road conditions typically found in rural areas may also contribute to the high percentage of accidents. Roads in these areas may lack proper upkeep, with issues like potholes, uneven surfaces, and inadequate signage, contributing to accidents. The predominance of these hazards is consistent with evidence that surface defects critically elevate

motorcycle crash risk because two-wheelers have less tire contact and stability; even modest friction reductions or discontinuities can precipitate loss of control. Guidance also stresses that pavement markings and treatments should avoid abrupt friction changes for motorcyclists. Targeted countermeasures include prompt pothole repair, skid-resistant surfacing, improved drainage, and maintenance standards that preserve wet-friction (Razali et al., 2024).

3.2 Environmental Condition

Table 3 shows the environmental conditions of car-to-motorcycle accidents.

TABLE 3: Road condition

Environmental Condition	Percentage %
Weather Condition	
Rain	6
Fine / Clear	94
Fog	0
Light Condition	
Daylight	89
Dust / Dawn	1
Night with Streetlight	10

According to Table 3, the majority of accidents occurred in clear weather conditions (94%) and daylight (89%), which typically provide better visibility. This suggests that factors such as poor visibility or environmental hazards like fog are not the primary contributors to accidents in this study. The relatively low incidence of rain (6%) and fog (0%) reinforces the notion that environmental conditions were not the leading cause of accidents, pointing more towards driver behavior and road conditions.

3.3 Impact Condition

Table 4 shows the impact condition of car-to-motorcycle accidents.

TABLE 4: Impact condition

Impact Condition	Percentage (%)
Colliding Area	
Approaching a stationary motorcycle	9
Approaching a braking motorcycle	17
Turning across the path of an oncoming motorcycle	25
Changing Lane across the path of an oncoming motorcycle	26
Changing Lane across the path of an overtaking motorcycle	17
Others	6
Car Maneuver Before Crash	
Moving in Straight Line	67
Turning Right	21
Turning Left	4
Passing Maneuver (on right)	8
Motorcycle Maneuver Before Crash	
Moving in a Straight Line	80
Turning right	12
Turning left	3
Passing maneuver (on right)	5
Motorcycle Body Impact	
Right side	26
Left side	13
Front	49
Rear	12

The fact that most crashes occurred while both the car (67%) and motorcycle (80%) were moving straight is consistent with pre-crash typologies, showing that many collisions begin with a vehicle proceeding straight ahead (e.g., rear-end, straight-crossing-path at intersections, and opposite-direction conflicts) before a critical event unfolds. NHTSA's scenario frameworks and on-scene investigations repeatedly code "going straight" as a common pre-event movement, underscoring that straight-line travel is not inherently low-risk when conflicts arise suddenly in front of the driver (Viano, 2025).

Moreover, the data reveals that the most frequent collision scenarios involved vehicles changing lanes across the path of an oncoming motorcycle (26%) and turning across the path of an oncoming motorcycle (25%). Both scenarios happen when one vehicle goes straight while the other initiates a turn. Updated U.S. statistics and classic field investigations (e.g., the Hurt Report) document high involvement of turning vehicles cutting across a straight-moving counterpart – often the motorcycle – at intersections. Thus, the predominance of straight-line vehicle travel in the data plausibly reflects crossing-path conflicts rather than loss-of-control events (Teoh, 2023).

The straight-line pattern also aligns with behavioral contributors. Naturalistic driving studies show that driver distraction/inattention (especially visual–manual tasks like dialing or manipulating a phone) substantially elevates crash risk when drivers are traveling straight, where situational monotony can mask developing hazards. Large-scale analyses report driver-related factors in the vast majority of crashes, with distraction markedly increasing odds of crash involvement. These findings support the interpretation that inattention likely played a role in a portion of the straight-line events in our sample (Dingus et al., 2016).

Likewise, speed is a well-established amplifier of both crash likelihood and severity during straight-line travel (by reducing time-to-collision and lengthening stopping distances). WHO and NHTSA data show that even small increases in mean speed measurably raise serious and fatal crash risk, and that roughly one-third of U.S. traffic fatalities are speed-related – patterns consistent with the interpretation that speeding may underlie part of the observed straight-line crashes (WHO, 2024).

Additionally, frontal impacts were the most common (49%), highlighting the need for safety measures that can address this type of crash, which is often more severe for motorcyclists. This aligns with prior research on motorcycle crashes, which found that approximately three-quarters of accidents involving motorcycles and cars involve frontal impacts (Sartori et al., 2025). Consequently, enhancing frontal conspicuity (e.g., using headlights or high-visibility gear) and improving the detection of oncoming vehicles could help reduce such incidents.

3.4 Injury Condition

Table 5 shows the injury conditions of car-to-motorcycle accidents. Regarding driver injuries, 93% of car drivers are not injured. These outcomes suggest that, in general, injuries are low among car drivers. However, motorcycle riders are known to suffer more serious injury outcomes due to their lack of enclosure and protective features, compared to car occupants (Lawson, 2025), with a notable 84% of motorcycle riders and 71% of their passengers sustaining some form of injury, though most were not fatal. This discrepancy highlights the relative vulnerability of motorcyclists in collisions. Passenger injury rates were notably lower than those for riders: 25% reported no injury. This contrast may be partially explained by differences in seating position and kinematics during collisions. Simulation-based studies suggest that in some collision scenarios – particularly frontal crashes at higher speeds – passengers may suffer more severe head injuries than riders, depending on factors such as vehicle speed, collision location, and angle (Lai et al., 2025). Though fatalities were absent in the data, the potential for severe head trauma remains in more extreme scenarios.

Moreover, Table 5 shows that upper body (48%) and leg (34%) impacts were the most common injury types, underscoring substantial exposure of both the torso and the legs. The relatively high helmet usage rate (67%) suggests efforts to reduce head injuries, which may have contributed to the low fatality rate observed. Literature consistently identifies head injuries as the leading cause of fatal and severe casualties in motorcycle-related traffic accidents (Petit, 2020). This emphasizes the critical importance of protective gear, especially helmets and upper-body protection, to mitigate injury risk. However, the presence of significant leg and upper-body injuries underscores the need for additional protective measures and safety innovations for motorcyclists.

TABLE 5: Injury condition

Injuries Condition	Percentage (%)
First Body Impact	
Head Impact	6
Upper Body Impact	48
Pelvis Impact	5
Leg Impact	34
Others	7
Driver Injury	
Injured	7
Not Injured	93
Fatal	0
Rider Injury	
Injured	84
Not Injured	12
Fatal	4
Passenger Injury	
Injured	71
Not Injured	25
Fatal	4
Helmet Use	
Yes	67
No	28
Others	5

3.5 Vehicle Type

Table 6 shows the vehicle type of car-to-motorcycle accidents.

TABLE 6: Vehicle type

Vehicle Type	Percentage (%)
Car Type	
SUV	6
Car	13
MPV	72
Others	9
Car Brand Type	
Honda	20
Perodua	0
Proton	1
Toyota	41
Nissan	3
Others	35
Motorcycle Type	
Scooter	0
Bike	90
Superbike	10
Motorcycle Brand Type	
Yamaha	10
Honda	64
Kawasaki	1
Modenas	0
Suzuki	1
Others	24

Table 6 highlights that MPVs (72%) and Honda cars (20%) were the most common vehicles involved in these accidents, likely due to their widespread use in Indonesia. The prevalence of motorcycles (90%) over scooters (0%) and superbikes (10%) shows the dominance of traditional motorcycles in crashes, pointing to the need for better safety systems tailored to these vehicle types. The prominence of Honda motorcycles (64%) could inform targeted safety interventions for specific vehicle brands commonly involved in crashes. The high representation of Honda likely reflects its popularity in the region rather than any inherent risk associated with the brand itself.

Although the brand of vehicle may not directly contribute to the primary objectives of understanding accident dynamics and safety features, it offers supplementary insights that can guide regulatory decisions, market-specific safety measures, and the development of vehicle safety technologies. This information can inform safety technology improvements, as different brands may have varying safety features or design characteristics that affect accident outcomes. Additionally, identifying the brand could highlight consumer behavior patterns, such as specific riding habits associated with certain motorcycles, or target specific models for further safety investigations.

3.6 The Contributions of Research on the Development of AEB MS by ASEAN NCAP

The real-world crash patterns documented in this study provide concrete parameters for region-specific testing of the Autonomous Emergency Braking for Motorcyclists System (AEB-MS), rather than relying on generic international scenarios. This direction is aligned with the ASEAN NCAP 2026–2030 Roadmap, which introduces a dedicated Motorcyclist Safety (MS) pillar and explicitly lists AEB-MC items and car-to-motorcyclist (C2M) test scenarios for the program. Integrating empirically common conflicts from Indonesia (e.g., frontal approaches with scooters and prevalent SUV/MPV geometries) into the test matrix would improve the ecological validity of AEB-MS assessments for the region (ASEAN NCAP, 2023).

The car-to-motorcycle crash scenario found in this research provides empirical, real-world crash patterns that ASEAN NCAP can incorporate as test protocols for AEB MS validation. Instead of generic test cases, the system can be tuned to scenarios that reflect the most common and dangerous situations in Indonesia. From the environmental and road condition aspect, this finding helps define the environmental conditions under which AEB MS should be tested. The vehicle type data allow ASEAN NCAP to prioritize region-specific vehicle profiles in their safety modeling. Testing with motorcycle bikes and common MPV geometries ensures the AEB MS is evaluated against the most representative traffic mix in Indonesia. The research found that most injuries from these accidents occurred to motorcycle riders and their passengers, with 49% of accidents involving frontal impacts, which commonly resulted in upper body and leg injuries. These patterns inform AEB MS performance metrics. If the system can prevent or reduce speed in frontal collisions, it can directly reduce the most frequent and harmful injury types. This can also help reduce accident fatalities, as frontal collisions are significantly more dangerous than other collision types, such as side or rear-end crashes (Widia et al., 2021a, 2021b). This claim is also backed up by similar research that showed how most drivers involved in other collision types, such as rear-end collisions, suffered no injury (Widia et al., 2021a, 2021b; Nadhirah et al., 2022). Table 7 shows how findings from this research can contribute to the ASEAN NCAP test protocol on the development of the AEB MS framework.

TABLE 7: Contribution of research findings to ASEAN NCAP on the development of AEB MS framework

Research Finding	Implication for AEB MS	Contribution to ASEAN NCAP Test Protocol
Road Categories: Most accidents occurred in suburban (46%) and rural (35%) areas.	AEB MS should be tested for rural and suburban settings where accidents are more frequent.	Test protocols should include road types of suburban (higher density, more intersections) and rural (lower density, higher speeds) areas to address the higher accident rate in these areas.
Road Intersections: Most accidents happened on straight roads (57%) and T-junctions (19%).	AEB MS needs to account for collision avoidance in intersection scenarios, particularly on straight roads and T-junctions.	Testing should include straight road and T-junction intersection scenarios to simulate real-world accident dynamics.
Weather and Lighting Conditions: 94% of accidents occurred in fine/clear weather, and 89% in daylight.	AEB MS should be optimized for clear weather and daylight conditions, as these represent the majority of accident scenarios.	Test protocols should focus on daylight and clear weather conditions, which are prevalent in most accidents.
Impact Conditions: 49% of accidents involved frontal impacts. The next most common impact areas were the right side (26%) and rear (12%).	AEB MS should prioritize frontal collision scenarios and work on reducing the severity of injuries from side and rear impacts.	AEB MS testing should simulate frontal impact scenarios, as these are the most common and hazardous collision type.
Collision Scenarios: Changing Lane across the path of an oncoming motorcycle (26%), Turning across the path of an oncoming motorcycle (25%)	Identifies rider-side misjudgments to be included in system detection.	Expands test cases to include car-motorcycle interaction dynamics.
Vehicle Maneuver Before Crash: Majority moving in straight line (67% for cars, 80% for motorcycle).	AEB MS must detect and react to conflicts even in non-complex trajectories (straight-line).	Ensures protocols include high-speed straight-line approach tests.
Injury Conditions: Upper body injuries (48%) and leg injuries (34%) were the most common, with 84% of riders injured.	AEB MS should aim to reduce upper body and leg injuries by mitigating frontal collisions.	Protocol performance metric: speed reduction before frontal impact.

4. CONCLUSION

The objective of this study was to analyze the key accident scenarios involving car-to-motorcycle collisions in Indonesia and provide data-driven insights for the development of safety technologies. The research successfully identified the main contributing factors to these accidents, including road conditions, environmental factors, impact scenarios, injury patterns, and vehicle types, which offer valuable insights for improving road safety. The findings indicate that suburban and rural roads, particularly straight roads, present significant risks due to factors such as speeding, driver inattention, and poor road maintenance. Environmental conditions such as clear weather and daylight were the most common during accidents, indicating that poor visibility was not a major contributing factor. Frontal collisions were identified as the most frequent impact scenario, often resulting in significant injuries, particularly to the upper body and legs. Additionally, MPVs and motorcycles, particularly from popular brands, were most frequently involved in accidents, suggesting that safety solutions should target the

most common vehicle types on the road. The study also emphasizes the importance of improving motorcyclist safety through region-specific protocols, particularly by integrating these findings into the ASEAN NCAP's development of the Autonomous Emergency Braking Motorcycle System (AEB MS). The results not only support the implementation of effective safety technologies but also offer valuable data for policymakers aiming to reduce motorcycle-related accidents and fatalities in Indonesia and other Southeast Asian countries.

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