

ITARDA INFORMATION

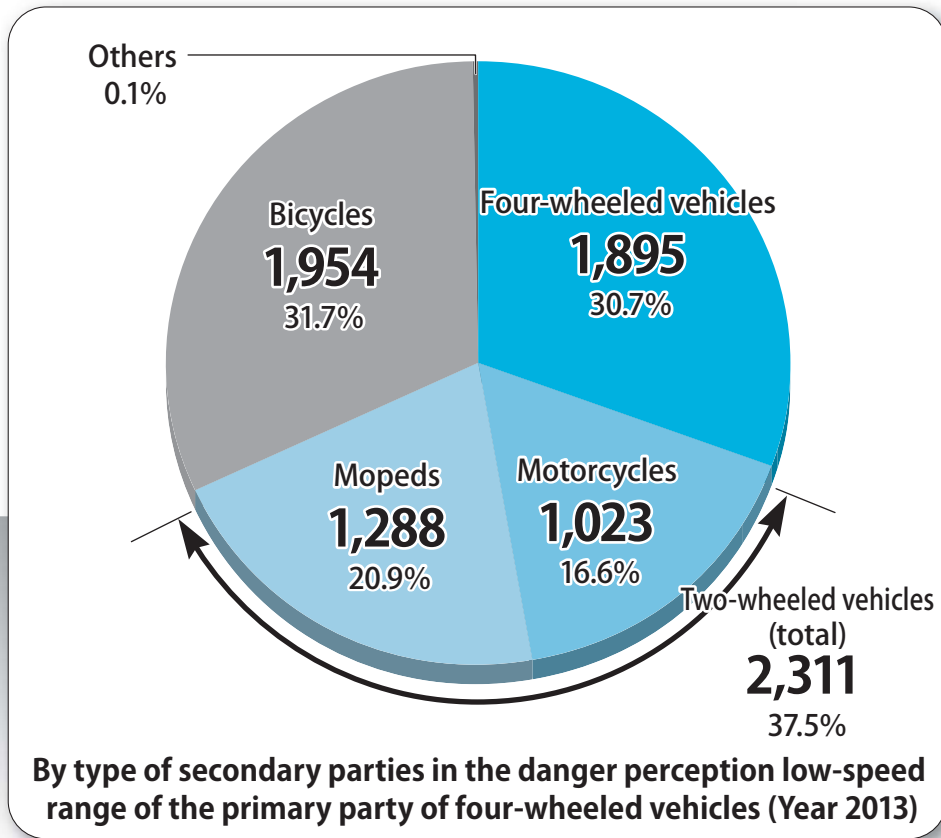
交通事故分析レポート

No.105

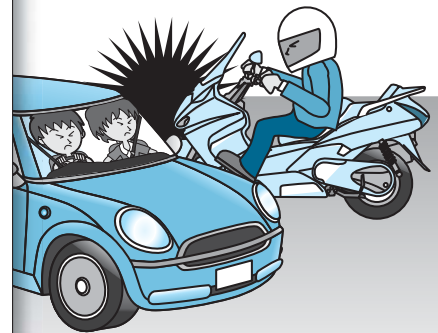
Special feature

Serious crossing collision of slow-moving four-wheeled vehicles with two-wheeled vehicles

~ Four-wheeled vehicles must exercise caution when making right turn at non-signalized intersections ~



Accident detail:
 Fatal and serious injury accidents
 Type of accident: Crossing collision
 Primary party: Four-wheeled vehicles
 Danger perception speed of primary party: 20km/h or less



1 Introduction	P2
2 Occurrence condition of serious accidents in the danger perception low-speed range of the primary party by type of accident vehicle to vehicle; crossing collision	P3
3 Characteristics of crossing collision between primary party of four-wheeled vehicles in the danger perception low-speed range and the secondary party of two-wheeled vehicles	P4
4 Case examples of accidents	P7
5 Conclusion	P9

1 Introduction

Year 2013 recorded a reduction in the number of fatal accidents in Japan for thirteenth year in a row, at 4278 cases. Though the reduction in fatal accidents is apparent, but what about the current situation of serious accidents?

Fig.1 shows the number of serious accidents (here it refers to accidents resulting in fatal and serious injuries) by the danger perception speed (*1) of the primary parties (*2) indicating that serious accidents are caused more often at the danger perception speed of 20km/h or less.

Let us now see what kind of serious accidents are caused in reality. Fig.2 shows the composition ratio of the type of serious accidents by the danger perception speed (DPS) of the primary party. Apparently, "pedestrian-vehicle" accidents account for a constant 21-25% of the total accidents regardless of the change in the DPS. Whereas in the low-speed range where the DPS is 20km/h or less, "vehicle-vehicle: crossing collisions" are the most, accounting for 32% of the total.

Therefore, in this issue of ITARDA Information we shall analyze the "vehicle-vehicle crossing collision" type of serious accidents that has occurred at the danger perception speed of 20km/h or less of the primary party (hereinafter referred to as "Low DPS of primary party")

*1: It refers to the speed at which any danger is perceived with respect to pedestrians or vehicles etc. To be more specific, it refers to the speed immediately before taking actions such as pressing the brake or steering the handle to avoid the accident. All motor vehicles starting from mopeds fall under this category.

*2: Primary party refers to the one bearing maximum culpability among the parties directly involved in a traffic accident. Whereas, in case the mistake lies equally with the concerned parties, it refers to the party that has sustained lesser injuries. The party opposite to the primary party is referred to as the secondary party.

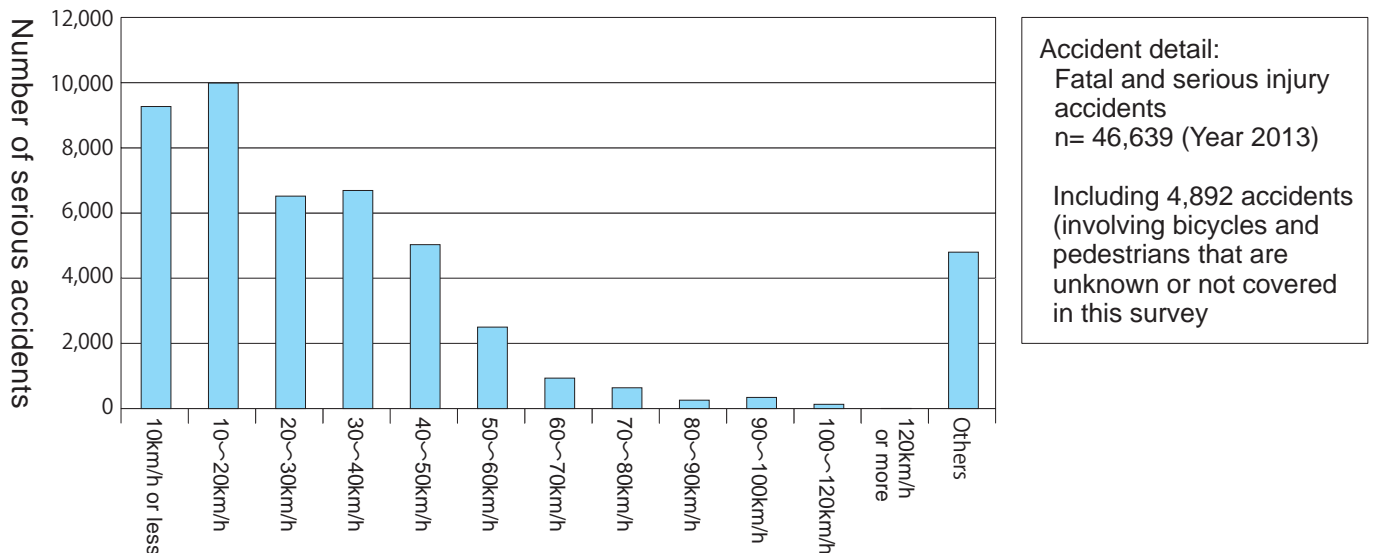


Fig.1 Number of serious accidents by the DPS of the primary party (Year 2013)

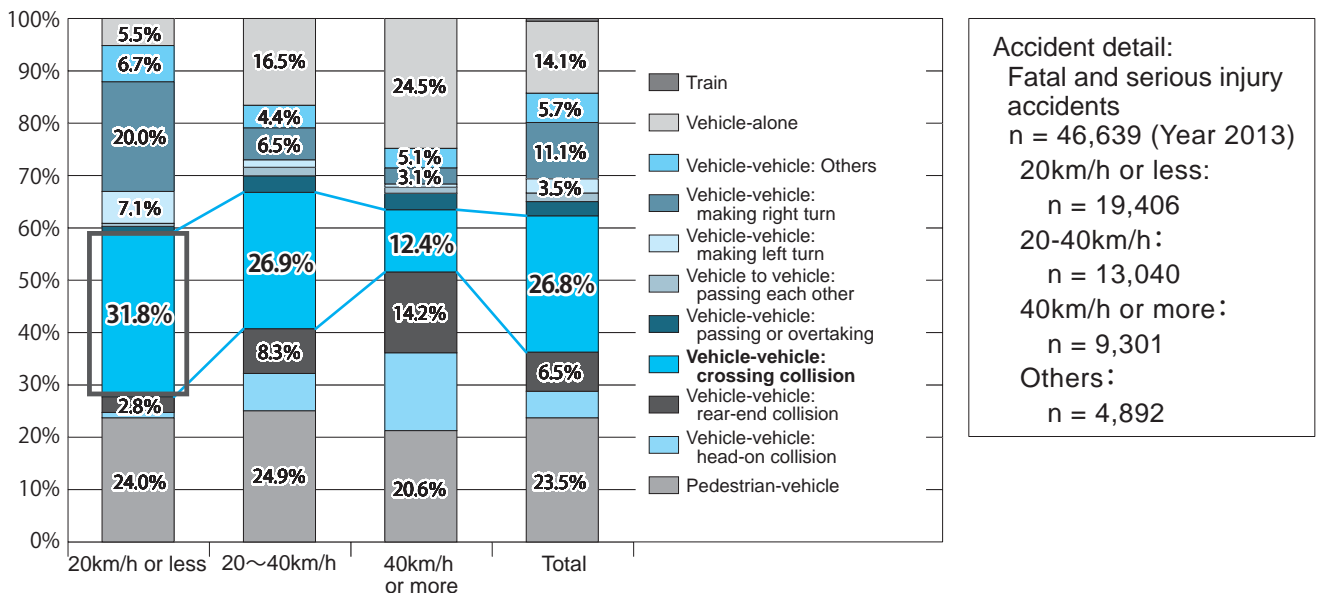


Fig.2 Type of serious accidents by DPS of primary party (Year 2013)

2 Occurrence condition of "vehicle to vehicle crossing collision" type of serious accidents in the Low DPS of the primary party ...

Let us first look into the characteristics of such serious accidents by the type of road users (primary and secondary parties) and by the place of occurrence.

■ By parties (primary and secondary)

Fig.3 shows the relation in terms of the primary and secondary parties involved in the accident. Whereas small and medium sized vehicles mainly constitute the primary parties, two-wheeled vehicles form the majority of the secondary parties, with the ratio of motorcycle and mopeds at 28% and the bicycles at 24%.

■ By place of occurrence

Fig.4 shows the situation by the place of occurrence such as signalized or non-signalized intersections (by road widths), near intersections, ordinary roads and so on. Evidently, 70% of the crossing collisions at low DPS of primary parties with the secondary party of motorcycles and bicycles have occurred at non-signalized intersections. Furthermore, more than half of such collisions took place at smaller intersections with road width 5.5m or less for the primary party of four-wheeled vehicles. Ordinary roads account for around 20% of the accidents.

In the next section, let us focus on the crossing collision between the primary party of four-wheeled vehicles (hereinafter referred to as "4W primary party") in Low DPS and the secondary party of two-wheeled vehicles (hereinafter referred to as "2W secondary party") and find out why accidents take a serious result, who all are involved and what sort of accidents occur and further analyze their causes.

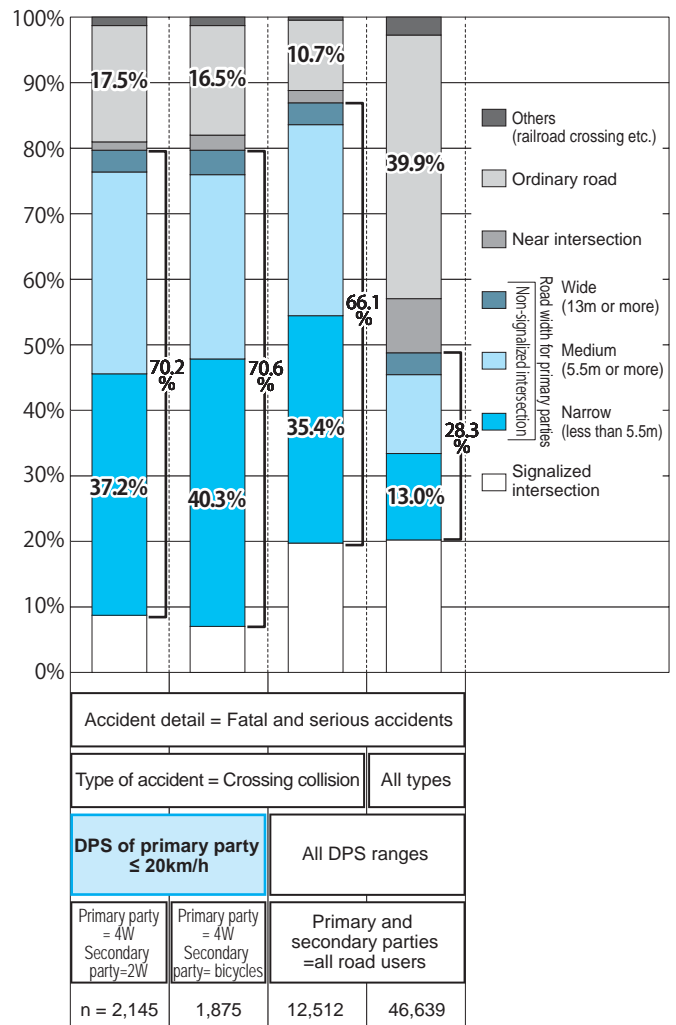
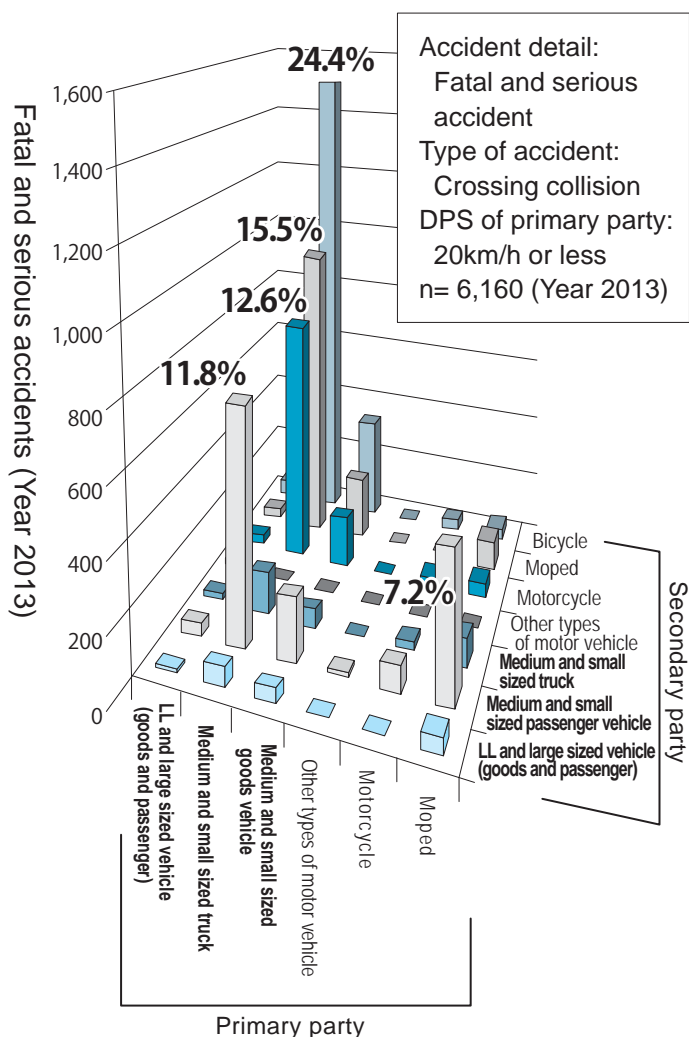


Fig. 3 Relation between parties in crossing collisions at the low DPS of primary parties (Year 2013)

Fig.4 Place of occurrence of crossing collisions in the low DPS of primary parties (Year 2013)

3 Characteristics of crossing collision between 4W primary party in low DPS and 2W secondary party

DPS of two-wheeled vehicle users

Surprisingly, serious accidents occur despite the low DPS of 20km/h or less of the primary party. Let us find out the reason.

About 80% of the crossing collisions occurred at the DPS of 20km/h or over of the secondary party, which is more as compared to that of the primary party (see Fig.5). Further, the higher the DPS of the secondary party, the higher the ratio of serious accidents becomes (see the line graph of Fig.5). In other words, if DPS of the secondary party is high, the accident becomes serious in nature despite the low DPS of the primary party.

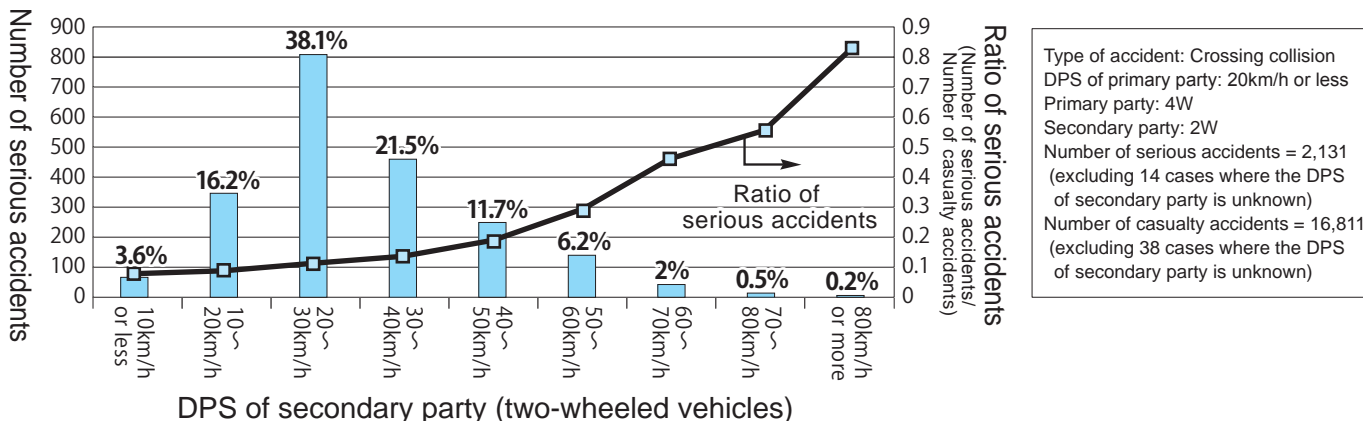
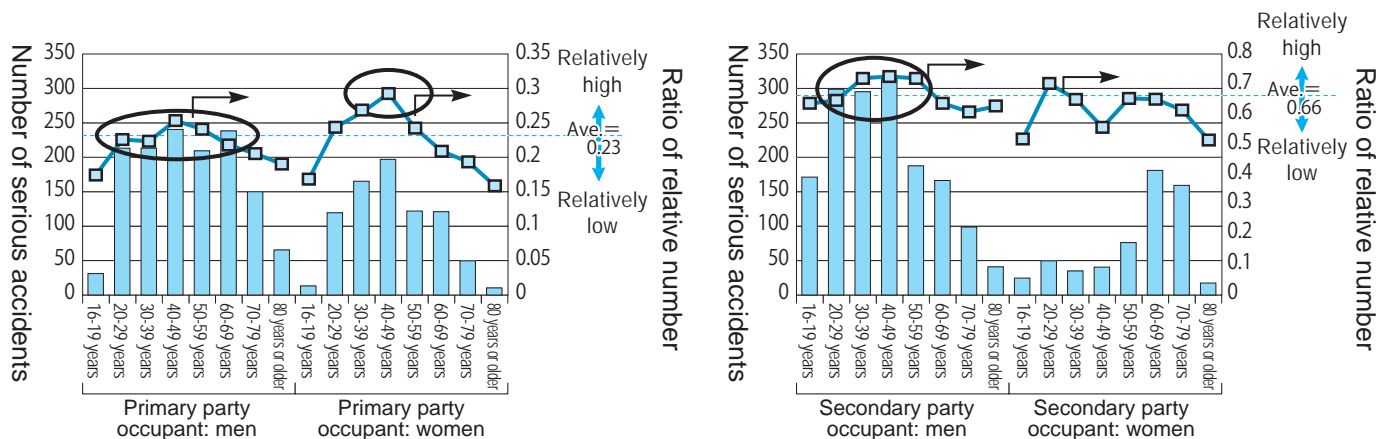


Fig.5 DPS of secondary party and the ratio of serious accidents (Year 2013)

Attribute of road users

Is there any peculiarity in the attributes (age and gender) of the 4W primary party and the 2W secondary party? Categorizing the characteristics of the primary party on the basis of their attributes shows that men of 20-69 years and women in their 40s are more often involved in serious accidents in the form of crossing collision with the 2W secondary party (see bar graph of Fig.6). Also, women in their 40s are more frequently (1.27 times the average) involved in crossing collisions with two-wheeled vehicles in Low DPS (see line graph of Fig.6).

Relatively, no major characteristic is visible in the attributes (age and gender) of the secondary party involved in crossing collision in the low DPS of the primary party (see line graph of Fig.7). However, the number of serious accidents involving men of age group 20-49 years is more (see bar graph of Fig.7).



(Vertical axis 1: Number of serious accidents)
 Number of accidents involving 4W primary party under below conditions (Total n=2,145)
 Type of accident: Crossing collision DPS of primary party:20km/h or less Secondary party: 2W

(Vertical axis 2: Relative composition ratio)
 Under above conditions, ratio achieved by dividing the "number of accidents by age and gender of primary party" by the "number of crossing collision type of serious accidents by age and gender of 4W primary party" acts as the pointer for indicating the extent of the relative number of accidents with the 2W secondary party in the Low DPS of the primary party.

(Vertical axis 1: Number of serious accidents)
 Number of accidents involving 2W secondary party under below conditions (Total n=2,145)
 Type of accident: Crossing collision DPS of primary party:20km/h or less Primary party: 4W

(Vertical axis 2: Relative composition ratio)
 Under above conditions, ratio achieved by dividing the "number of accidents by age and gender of secondary party" by the "number of crossing collision type of serious accidents by age and gender of 2W secondary party" acts as the pointer for indicating the extent of the relative number of accidents with the 4W primary party in the Low DPS.

Fig.6 Number of accidents by attributes of primary party (Year 2013)

Fig.7 Number of accidents by attributes of secondary party (Year 2013)

Moving direction and type of movement of primary and secondary parties in traffic accident

Next, let us look into the relation between the moving direction of 4W primary parties and 2W secondary parties as well as the number of serious accidents, majority of which occur at “non-signalized intersections” and “Ordinary roads.”

In the case of ordinary roads, the ratio of slow-moving four-wheeled vehicles making a right turn (including those making right turn from outer roads) colliding with two-wheeled vehicles moving ahead from the right side, is high (see Fig.8, cases 1A,1B). Whereas at the non-signalized intersections, straight-moving two-wheeled vehicles colliding with four-wheeled vehicles on their right or left side when the latter is also moving straight on, is high (see Fig.8, cases 2B, 2C). Same as in cases 1A and 1B of ordinary roads, two-wheeled vehicles coming from the right side colliding with the four-wheeled vehicles when the latter is making right turn, is most common (see Fig.8, case 2A).

Accident summary	Type of accident = Crossing collision Accident detail = Fatal and serious accident Primary party = 4W DPS of primary party ≤ 20km/h Secondary party = 2W (Motorcycles & mopeds)							
Road configuration	Ordinary roads (incl. near intersections)				Non-signalized intersections			
Case	1A	1B	1C	Others	2A	2B	2C	Others
Moving direction and type of movement of primary and secondary parties	Major case	Second most common case	Third most common case	Others	Major case	Second most common case	Third most common case	Others
	Primary party: Making right turn from outer road Secondary party: Going straight (on the right side of primary party)	Primary party: Making right turn Secondary party: Crossing the road (on the right side of primary party)	Primary party: Making right turn Secondary party: Going straight on (slipping past the right side of primary party)		Primary party: Making right turn Secondary party: Going straight (on the right side of primary party)	Primary party: Making right turn Secondary party: Going straight (on the left side of primary party)	Primary party: Going straight on Secondary party: Going straight (on the right side of primary party)	
Number of fatal and serious accidents	114 26.5%	69 16.0%	51 11.9%	196 45.6%	370 24.6%	325 21.6%	321 21.3%	489 32.5%
	340				1506			

Fig.8 Moving direction of primary and secondary parties at ordinary roads and intersections (Year 2013)

Main cause of accidents

Let us now analyze the main causes of such serious crossing collisions individually in 4W primary parties and 2W secondary parties.

Human factors leading to accidents in primary parties point at the fact that, the slower the DPS, the greater the frequency of “delay in noticing” becomes and the rate is about 90% in the low DPS of the primary party (Fig.9). Further, the breakdown of “delay in noticing” shows that inadequacy in the safety check of the surroundings increases with decrease in the DPS and 75% of such accidents in the low DPS of the primary party are caused due to this reason (Fig.10). In other words, the major cause of accidents with the other party is delay in noticing due to inadequate safety check of the surroundings by the 4W primary party.

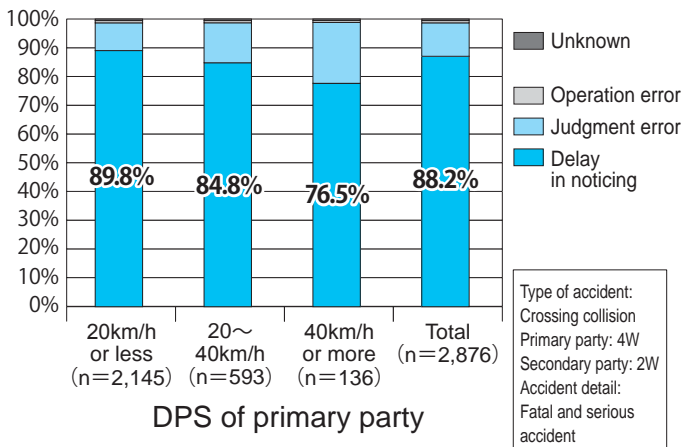


Fig. 9 Human factors of primary parties (Year 2013)

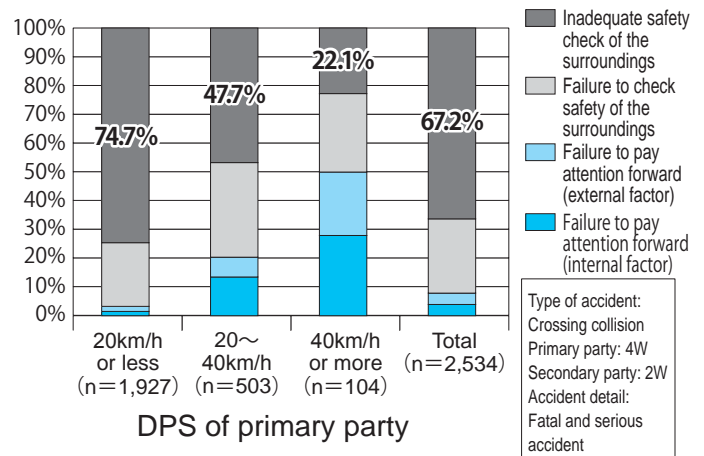


Fig. 10 Breakdown of "Delay in noticing" of primary party (Year 2013)

In the case of secondary parties, similarly the human factor of “delay in noticing” leads to more accidents. However the breakdown shows that “judgment error” accounts for about 42% (Fig.11) especially in the low DPS of primary party which is four times the rate as compared to that of primary party which is around 10 percent. Further, the breakdown of “judgment error” shows that failure to observe the surrounding traffic movement (did not watch carefully anticipating the other party would yield to and did not watch carefully as there was no apparent danger) accounts for the majority of the causes at about 63% (Fig 12). This indicates that the 2W secondary party ends up falling prey to crossing collisions because they continue riding at a high speed without sensing any danger. In the following section, let us study the typical case example of accidents of four-wheeled vehicles colliding with the two-wheeled vehicles coming from the right side while making a right turn at the intersection (Case 2A of Fig.8) and think of versatile preventive measures for the same.

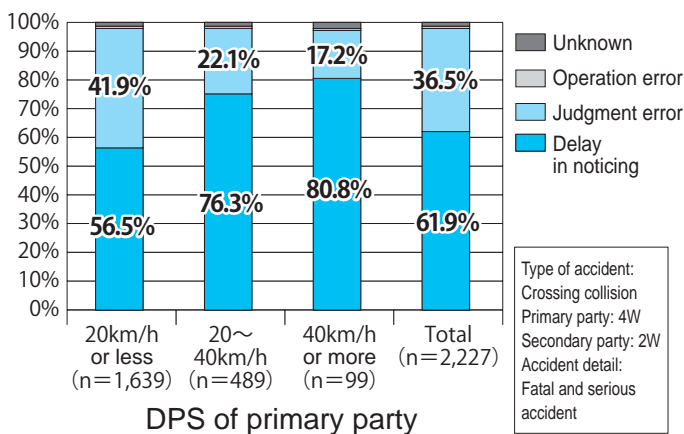


Fig. 11 Human factors of secondary parties (Year 2013)

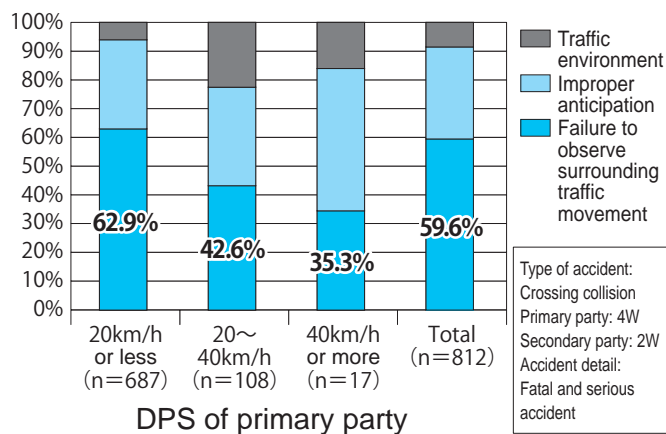


Fig. 12 Breakdown of “Judgment error” of secondary party (Year 2013)

4 Case examples

Situation of accidents

On a weekday morning, Ms. A (40 years old, driving a medium-sized vehicle) was trying to make a right turn at a small non-signalized T-intersection with a road width of 5.4 meters. Since the road was lined by fences of about 1.6m high on either side obstructing the view of both sides of the facing road, Ms.A paused her vehicle before the intersection and checked the traffic condition of both side roads on the curve mirror on her front. Since no vehicle was appearing on the mirror she slowly started making a right turn. But unable to notice Mr.B (in his twenties, riding a motorcycle) who was coming from her right side at a speed of 50km/h, her vehicle collided with Mr.B (Fig.13).

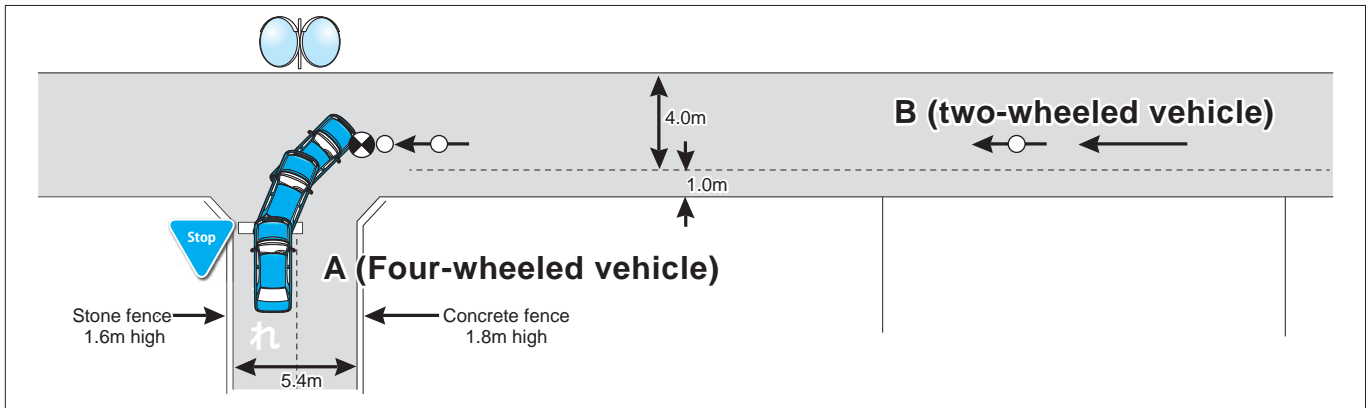


Fig.13 Figure showing the situation of the accident site

Deliberations to prevent accidents

How can the aforementioned accidents be prevented? Let us consider the situation from the viewpoint of both the four and two-wheeled vehicles.

Let us start with the four-wheeled vehicle. In the above example, despite of checking the safety in terms of an approaching vehicle on both sides of the road on the curve mirror, it met with an accident. There we tested as to how much visible the traffic movement is to a four-wheeled vehicle, on the curve mirror.

As shown in Fig.14, colored cones were placed on the positions X1, X2 and X3, and photographs were directly taken from the center of intersection X0 which is similar to visual observation (photo1) and from position A1 at a height of 1.25m assuming the viewing position of driver occupying the four-wheeled vehicle as appearing on the curve mirror (photo2). The two photographs were then compared. Even when seen by naked eye, as the surface area of the color cones is inversely proportional to the square of the distance, they will appear small and much smaller on the curve mirror. This is because the curve mirror is so designed as to reflect as much information as possible (visual field) on the opposite side in a compressed state. In layman's words, an object more than 30m away will appear less than one-two hundredth of its actual size on the curve mirror. That is, a motorcycle 30m away will appear only a few centimeters in size on the curve mirror. So not only is it difficult for a driver to notice the motorcycle which appears much smaller on the 5m distant curve mirror, but also to correctly judge its approaching speed and distance.

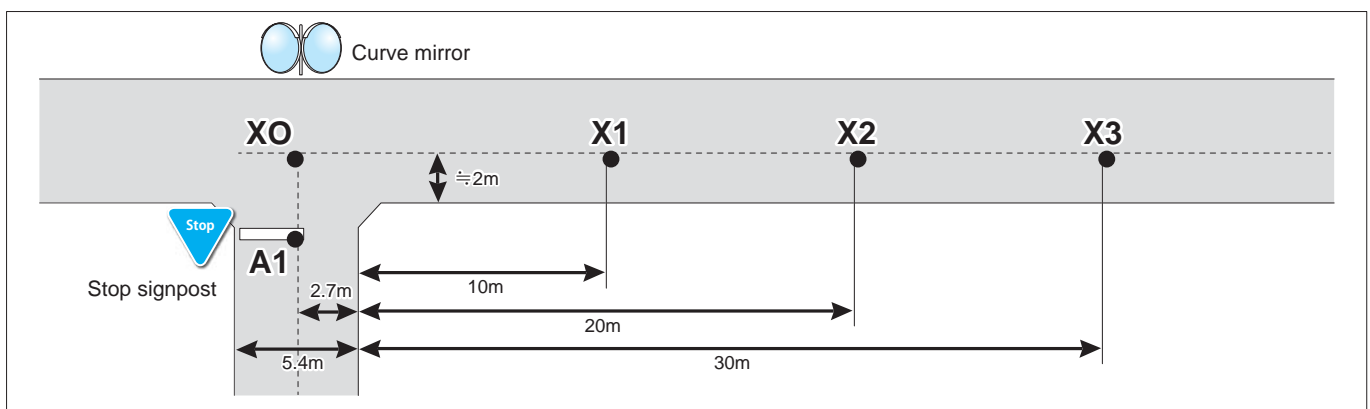


Fig.14 Relative distance of photos taken at the accident site



Photo 1 Photos of colored cones as seen from X0 position (from left: X1, X2 and X3)



Photo 2 Photos of colored cones as appearing on the curve mirror from A1 position (from left: X1, X2 and X3)

At intersections where the visibility is poor, although it is important to check the safety of surroundings using a curve mirror, it is dangerous to rely too much on this information alone.

As inverted image is reflected on the curve mirror, the traffic situation may appear too confusing to be understood correctly. Similarly it is difficult to read the size, location and approaching speed of the two-wheeled vehicle appearing so small on the curve mirror. It is crucial to restrict the use of curve mirror to check the existence of any approaching vehicle and to confirm visually, before finally deciding to start your vehicle. The ideal way of visual confirmation is to first stop your vehicle at the stop line and check the presence of any approaching vehicle on the intersecting road on the curve mirror. Then slowly move forward little by little till your vehicle enters the other road while securing the visibility on your left and right sides. This will help you to make a stable judgment and warn your presence to other vehicles at an early stage, thus preventing a possible accident. It is also advisable to switch on your turn signal lights or head lights in order to let other vehicles know your presence soon enough.

Coming to two-wheeled vehicles, however accustomed you are with the route you are riding, it is important that you are conscious about the presence of intersections, especially non-signalized ones, entry and exit points of other vehicles and make sure on a routine basis to control your speed when you approach such areas. Since it is much easier for a two-wheeled vehicle going straight on to notice an approaching four-wheeled vehicle (larger size), the former could keep distance in order to prevent any accident. Near such areas where you notice potential dangers such as vehicle or human movement, it is of vital importance to adequately control your speed beforehand. It can be dangerous especially while riding straight on priority roads that are narrow. Two-wheeled vehicle riders could also take care at places where curve mirrors are placed at small intersections.

5 Conclusion

The characteristics of crossing collision between the slow-moving primary party of four-wheeled vehicle and the secondary party of two-wheeled vehicle are as follows:

- Despite the low speed of the primary parties, many of the secondary parties are driving at a high speed which results in serious accidents.
- Female drivers in their forties driving four-wheeled vehicles as the primary party at Low DPS account for relatively more crossing collisions with the secondary party, while young men riding two-wheeled vehicles as the secondary party meet with more accidents.
- In the case of primary parties, the human factor of “delay in noticing” due to inadequate safety check of the surroundings is more common. In the case of secondary parties, “judgment error” is a more common cause as compared to that of the primary parties. Further breakdown of this cause shows that 63% of accidents are caused due to “failure to observe surrounding traffic movement” such as “did not watch carefully anticipating the other party would yield to and “did not watch carefully as there was no apparent danger”.
- On ordinary and small roads with road width 5.5m or less with non-signalized intersections, crossing collision of four-wheeled vehicles trying to make a right turn with two-wheeled vehicles coming straight from the right side, is a typical case of accident that occurs more often. (Case 1A, 1B and 2A of Fig.8 of Chapter 2).

Following are the points to be careful of so as to prevent such serious accidents at the danger perception low speed range.

Four-wheeled vehicles making a right turn (or going straight on) must...

- visually confirm safety of the surroundings without fail: At intersections with poor visibility, although it is alright to check the presence of other vehicles on the curve mirror, but one should never rely on this information alone. Slowly move forward little by little while securing the visibility and always confirm visually one last time before you proceed.
- make cautious decision: When making a right turn or passing through a non-signalized intersection, proceed only when you are more confident with the timing than that of your habitual driving scene. If you still have any doubt, do no rush and wait until you are confident enough to proceed.
- improve conspicuity: Make use of turn signal lights or head lights to let other vehicles know your presence or movement easily.

Two-wheeled vehicle going straight on must...

- enhance your danger awareness on a routine basis: Always be highly cautious while riding straight on a preference road about the presence of any non-signalized intersections and road entries or exits ahead. Always perceive potential danger in such areas. If you notice any human or vehicle movement in these areas, reduce the vehicle speed and proceed carefully.
- improve conspicuity: Make use of the head light to let other vehicles know your presence (or speed) easily, even during daytime.

(Takashi Takemoto)

当センターは、平成4年(1992年)に国家公安委員会、運輸省(当時)、建設省(当時)から設立許可を受けて、公益法人として設立されました。その後平成24年(2012年)4月に公益財団法人に移行しました。我が国で唯一道路交通法の定める「交通事故調査分析センター」の指定を国家公安委員会から受けた調査研究機関であり、交通事故の防止と被害の軽減のための交通事故の調査分析を行っています。

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