イタルダ インフォメーション

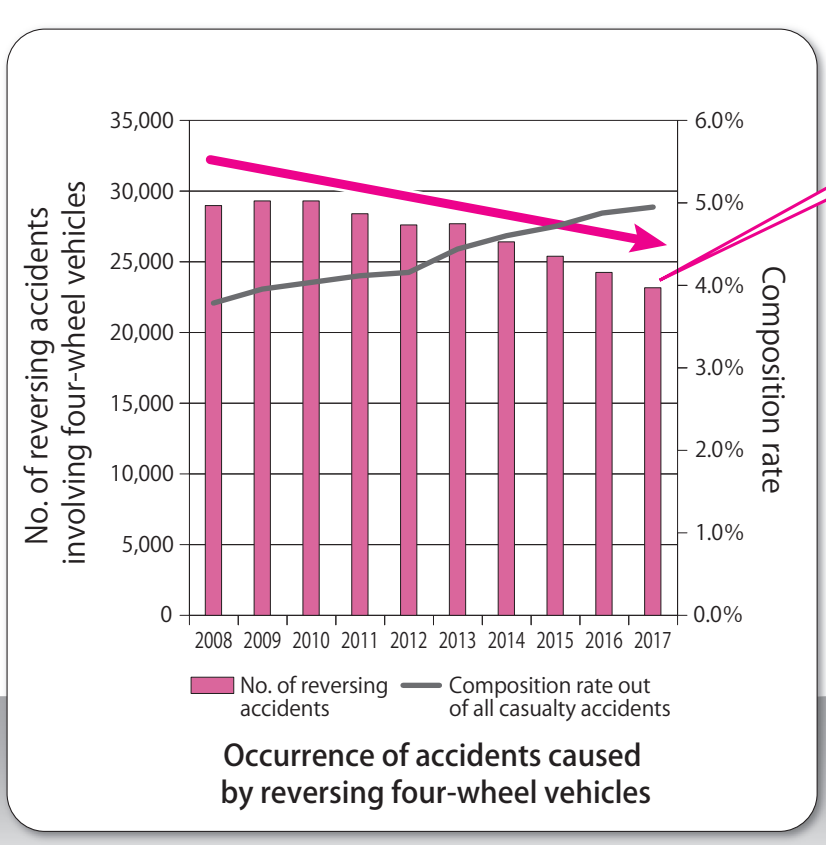
ITARDA INFORMATION

交通事故分析レポート No.128

Special feature

Accidents when four-wheel vehicles are reversing

~ Drivers must thoroughly check behind them, especially in parking lots! ~



Occurrence of accidents caused by reversing four-wheel vehicles

The number of accidents is gradually decreasing!

1 Introduction

You may have recently caught one of the announcements to the effect that the aim for the future is to reach zero traffic accidents, along with the expanded adoption of preventative safety equipment and the introduction of self-driving cars. To achieve this goal, we must perform analyses of accidents that we have not had the opportunity to focus on thus far. Therefore, this issue will focus on accidents that occurred as a result of collisions with four-wheel vehicles that were reversing (hereinafter referred to as “reversing accidents”), and will take a look at the specific sorts of conditions under which they occur. The graph on the front cover shows the number of reversing accidents over the ten-year period from 2008 - 2017 in which a four-wheel vehicle was the primary party (of the parties involved in an accident, this refers to the party that was at greatest fault) along with their composition rate out of the total number of casualty accidents. It also reveals that the number of reversing accidents is gradually decreasing. Utilizing the back monitor is believed to be effective when reversing one’s vehicle. As such, Fig. 1 shows the trends in the percentage of passenger vehicles equipped with back cameras versus the number of new models shipped up through 2016. This shows that the percentage of vehicles equipped with cameras has continued to rise since 2011, which has presumably contributed to the recent decline in the number of reversing accidents. Yet on the other hand, the composition rate of reversing accidents continues its growth trajectory, as indicated from the figure on the front cover, which indicates that the need for countermeasures for these grows greater by the year. Table 1 shows the number of all accidents and of reversing accidents over a ten-year period by the accident’s degree of severity, as well as the composition rate of reversing accidents out of the total number of accidents. The numbers in parentheses indicate the number of accidents caused by a misapplication of the accelerator and brake pedals, with the table indicating that approximately 10% of fatal accidents and approximately 3% of serious injury accidents were caused by misapplication of the pedals. However, these only account for approximately 1% of slight injury accidents (which account for the majority of casualty accidents), from which it can be concluded that most reversing accidents involving casualties occur due to reasons other than misapplication of the pedals. From the table it can be seen that the number of fatal accidents is small at 610 such accidents, which is not a sufficient number for the analysis to be performed here. Therefore, for the subsequent analysis we will look at the accidents by dividing them into two categories: fatal / serious injury accidents (which combine fatal accidents with serious injury accidents) and slight injury accidents.

Table 1. Occurrence of reversing accidents by severity of injuries (2008 - 2017)

Fatal accidents			Serious injury accidents			Slight injury accidents		
Reversing accidents			Reversing accidents			Reversing accidents		
No.	Composition rate	Total No.	No.	Composition rate	Total No.	No.	Composition rate	Total No.
610 (75)	1.4%	43,345	10,840 (361)	2.5%	434,990	260,654 (2,375)	4.5%	5,820,001

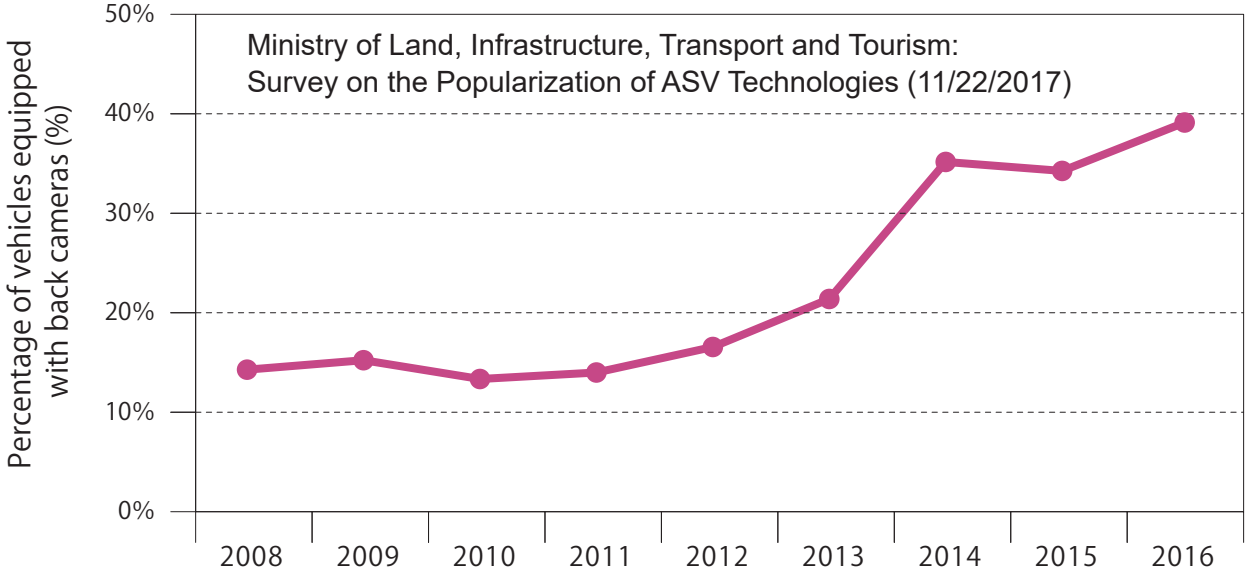


Fig. 1. Trends in the percentage of vehicles equipped with back cameras out of the net number of passenger vehicles produced

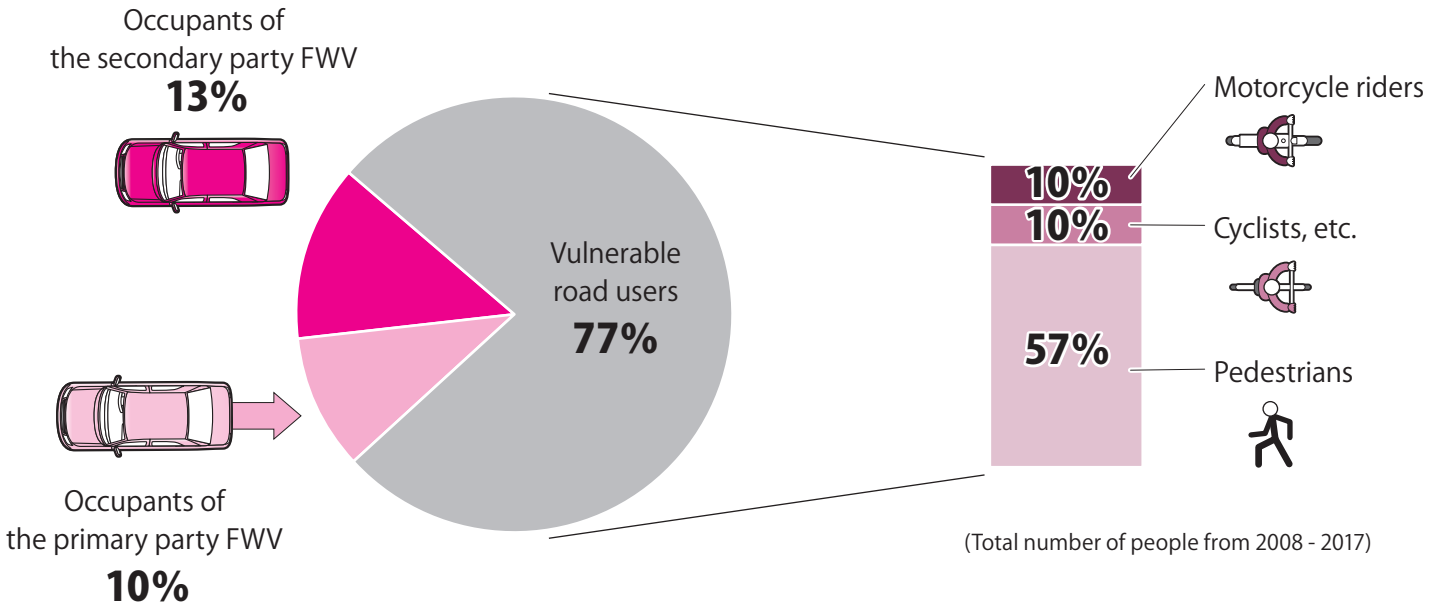


Fig. 2-1. Number of fatality / serious casualty accidents by party (Total = 11,598)

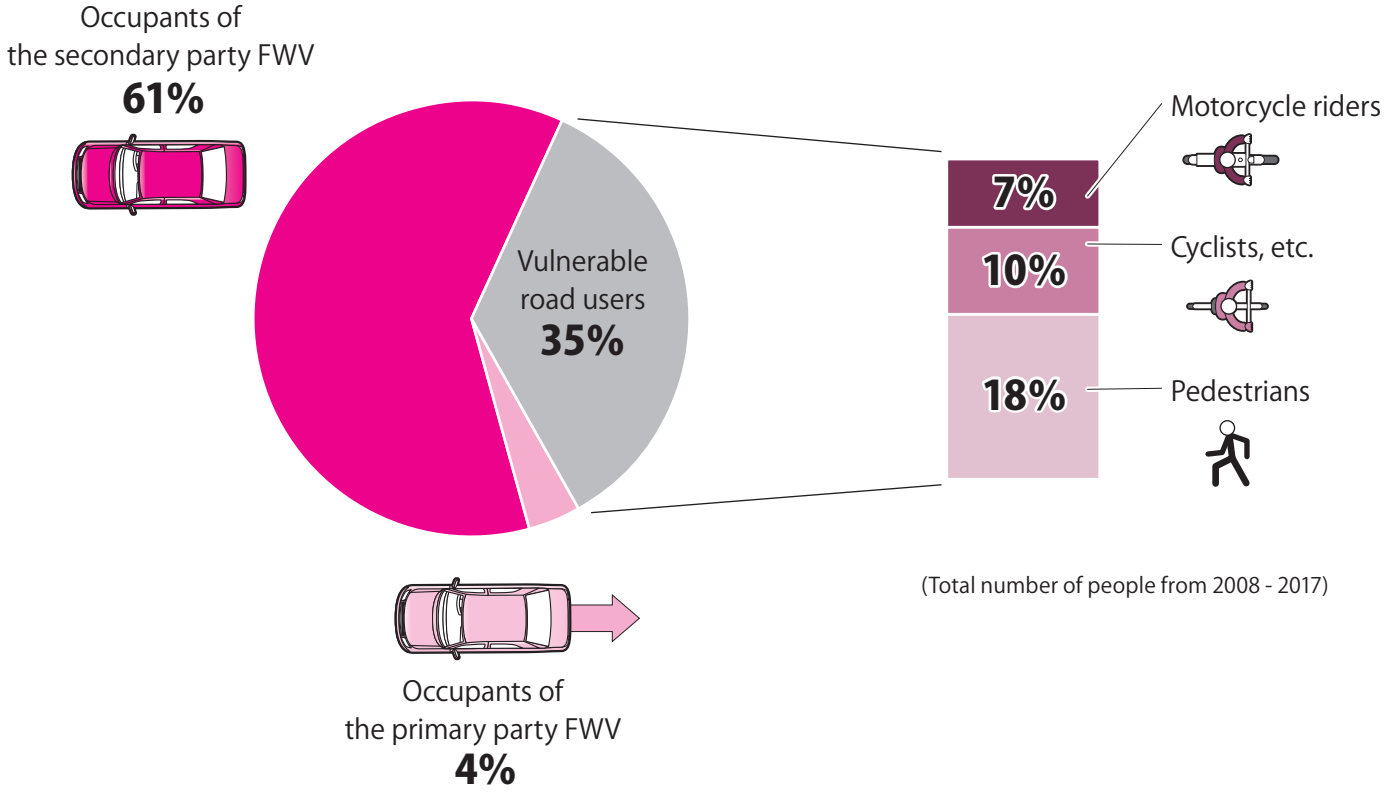


Fig. 2-2. Number of slight casualty accidents by party (Total = 299,694)

Fig. 2-1 shows the number of people who suffered fatalities / serious injuries due to reversing accidents, while Fig. 2-2 shows the number of slight injuries resulting from said accidents. “Occupants of the primary party four-wheel vehicle” refer to the occupants of the reversing vehicle, while “occupants of the secondary party four-wheel vehicle” refer to the occupants of the vehicle that the reversing vehicle collided with. In addition, for this analysis motorcycle riders, riders of bicycles and similar vehicles, and pedestrians were consolidated together and collectively defined as “vulnerable road users.” According to these figures, three-fourths of the fatalities / serious injuries were accounted for by vulnerable road users. Moreover, it is noteworthy that pedestrians accounted for three-fourths of all vulnerable road users. What is more, occupants of the secondary party four-wheel vehicle account for the majority of persons who suffered slight injuries, with vulnerable road users accounting for just shy of 40% of these (with pedestrians accounting for the majority of this figure in turn). The reason for why these vulnerable road users account for a particularly large share of those suffering fatalities / serious injuries will be discussed next.

② Statistical analysis of accidents in which vulnerable road users suffered casualties from reversing accidents

■ Speed of the reversing vehicle

Fig. 3 shows the danger perception speed (speed the driver was traveling when they became aware of the danger) of the reversing vehicle involved in fatality / serious injury accidents. Most reversing accidents occur at low speeds of 10km/h or less, with this indicating that few such accidents occur in the speed range over 10km/h.

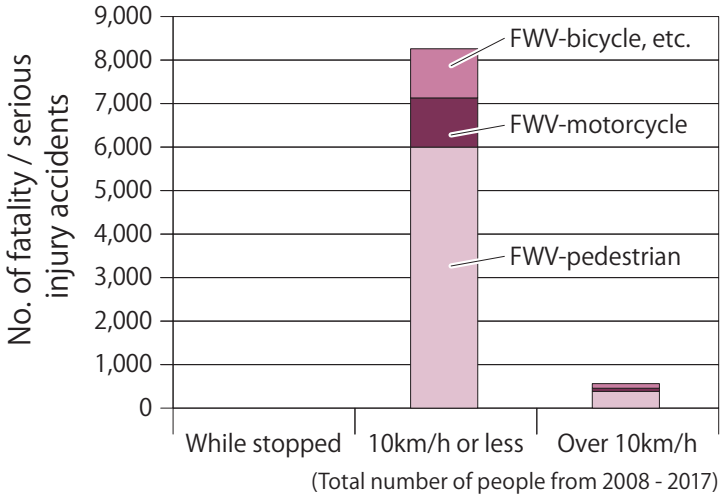


Fig. 3. Danger perception speed of the primary party for reversing accidents involving fatalities / serious injuries

■ Locations where reversing accidents occur

Now then, at what sorts of locations do reversing accidents occur? Fig. 4-1 shows the locations where fatality / serious injury accidents occurred, while Fig. 4-2 shows the locations of slight injury accidents. The term “general traffic areas” in the figures refer to plazas and other locations where the road width cannot be easily measured, as well as the service areas and parking areas along expressways and the like. It has virtually the same meaning as parking lots. These general traffic areas have virtually the same composition rate as uninterrupted road section in accounting for fatal / serious injury accidents at 43.7% and 39.7%, respectively. But we can see that only at general traffic areas do four-wheel vehicle-pedestrian accidents account for the majority of accidents. Moreover, while the order is reversed for slight injury accidents with uninterrupted road section at 41.9% and general traffic areas at 36.4%, there is an extremely high number of four-wheel vehicle-pedestrian accidents at general traffic areas, the same as for fatal / serious injury accidents. From this, it can be assumed that there are numerous scenarios in which reversing vehicles collide with pedestrians in parking lots and similar areas. Conversely, bicycles and similar vehicles and motorcycles are frequently involved in accidents at intersections (including the vicinity around them) and uninterrupted road section. Therefore, the assumption is that these vehicles frequently collide with reversing vehicles while they are in motion.

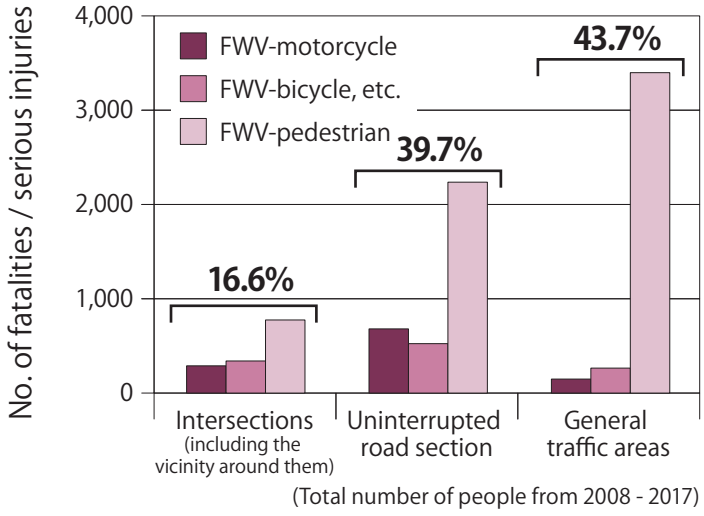


Fig. 4-1. Locations where reversing accidents involving fatalities / serious injuries occur

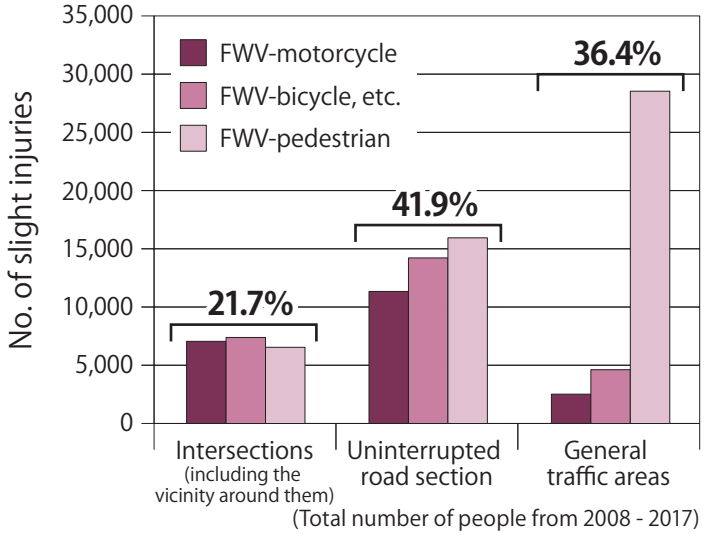


Fig. 4-2. Locations where reversing accidents involving slight injuries occur

■ Ages of vulnerable road users injured in reversing accidents

We tend to imagine that very young children account for a large number of the people injured in collisions by reversing four-wheel vehicles, but is this actually the case? To find out, age-based distributions of vulnerable road users who suffered injuries are shown in Fig. 5-1 for fatality / serious injury accidents and in Fig. 5-2 for slight injury accidents.

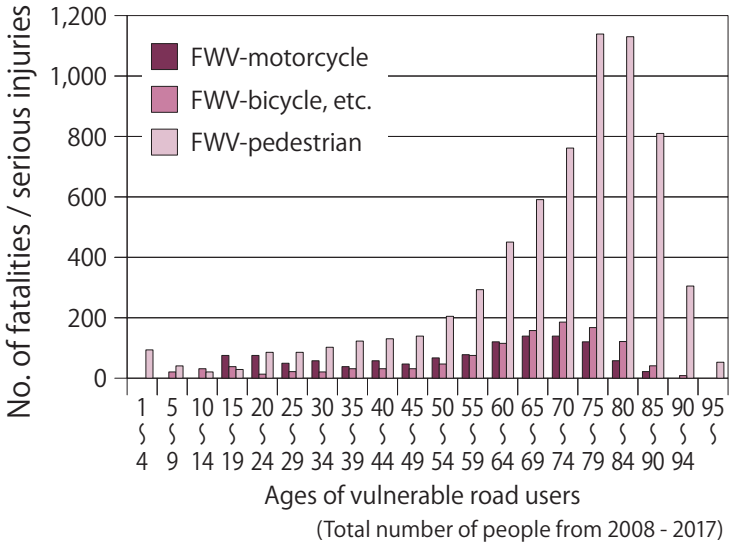


Fig. 5-1. Ages of vulnerable road users injured in reversing accidents involving fatalities / serious injuries

The number of accidents in which very young children suffered injuries is extremely small. Rather, with fatality / serious injury accidents it became apparent that in real-world conditions, elderly people were more likely to suffer from reversing accidents in one form or another, whether as pedestrians or from riding bicycles or motorcycles. This is presumably influenced by the fact that even when they suffer similar levels of harm as a young person, it tends to result in more severe injuries with elderly people. As for slight injury accidents, the graph reveals that the young and elderly groups frequently suffer injuries when riding bicycles or similar vehicles or as pedestrians. It also shows that with motorcycles there is a wide distribution across age groups, though it peaks with the young group.

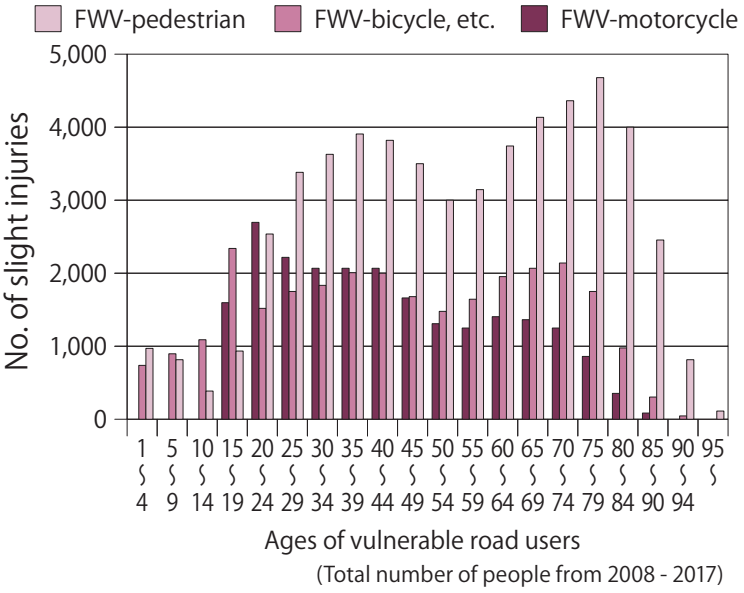


Fig. 5-2. Ages of vulnerable road users injured in reversing accidents involving slight injuries

■ Ages of the drivers of four-wheel vehicles

Lastly, we will take a look at the ages of the drivers of the four-wheel vehicles that were reversing. However, it is estimated that even if we look at this based on the number of drivers who caused reversing accidents, the number will be close to the distribution for the number of licensed drivers. Therefore, in this paper this was converted to the number of casualties per 10,000 licensed drivers for each age group, with the results of this shown in Fig. 6. According to this, people in all of the age groups cause these accidents, and therefore all drivers, regardless of age, must be consciously aware of the fact that they are at equal risk of becoming involved in a reversing accident.

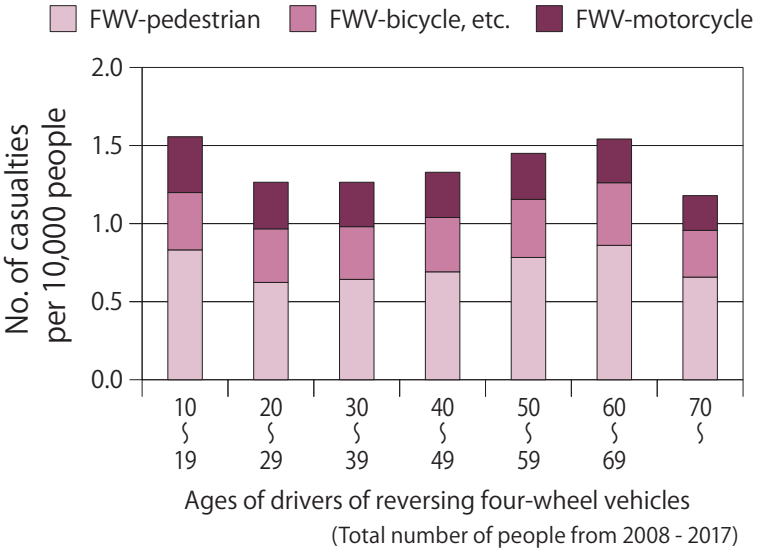


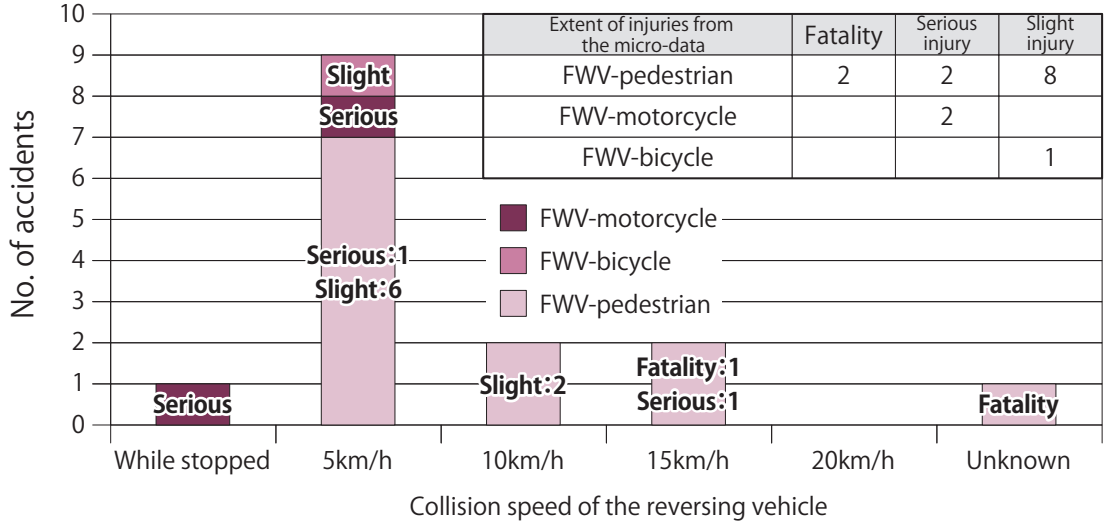
Fig. 6. Ages of the drivers of four-wheel vehicles who caused reversing accidents involving casualties

❸ Analysis via the traffic accident sample data

This section will present the results of an analysis of 15 reversing casualty accidents between four-wheel vehicles and vulnerable road users. These cases were taken from the individual accident sample data (hereinafter referred to as “micro-data”) surveyed by the Institute for Traffic Accident Research and Data Analysis (ITARDA).

■ Speed of the reversing vehicle

The collision speeds (estimated collision speeds calculated by the surveyors) are shown in Fig. 7. This diagram is superimposed over the table listing the accidents by type of party and the extent of the injuries suffered. The results of Fig. 3 showed that many of these accidents occurred at or below 10km/h, but according to the micro-data nine of these cases (more than half) occurred at a speed of right around 5km/h. Cases where the collision speed is listed as “While stopped” refer to cases where the driver of the four-wheel vehicle stopped in such a way that it was blocking the lane after detecting a motorcycle approaching from the side, and the motorcycle collided into the side of the vehicle.



Extent of injuries from the micro-data	Fatality	Serious injury	Slight injury
FWV-pedestrian	2	2	8
FWV-motorcycle		2	
FWV-bicycle			1

Fig. 7. Collision speed of the four-wheel vehicle in reversing accidents involving casualties found in the micro-data

■ Locations where reversing accidents occur

The locations where the 15 accidents from the micro-data occurred are shown in Fig. 8. From the results of this, we can affirm that many of the pedestrians were involved in collisions with reversing vehicles within parking lot-related facilities. Therefore, this is largely consistent with the result from Figs. 4-1 and 4-2 that many of the accidents between four-wheel vehicles and pedestrians occur in general traffic areas.

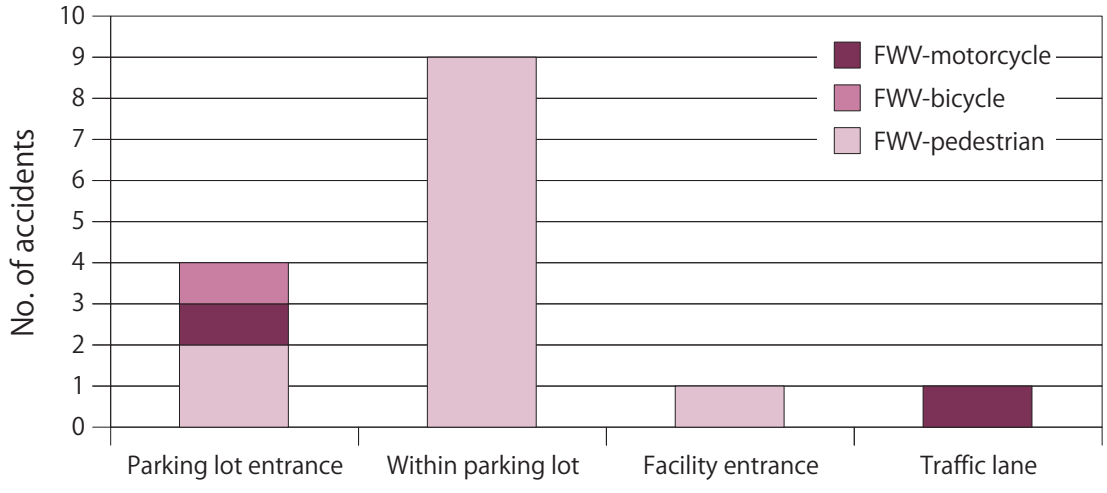


Fig. 8. Locations where reversing accidents involving casualties occurred found in the micro-data

4 Analysis via the traffic accident sample data

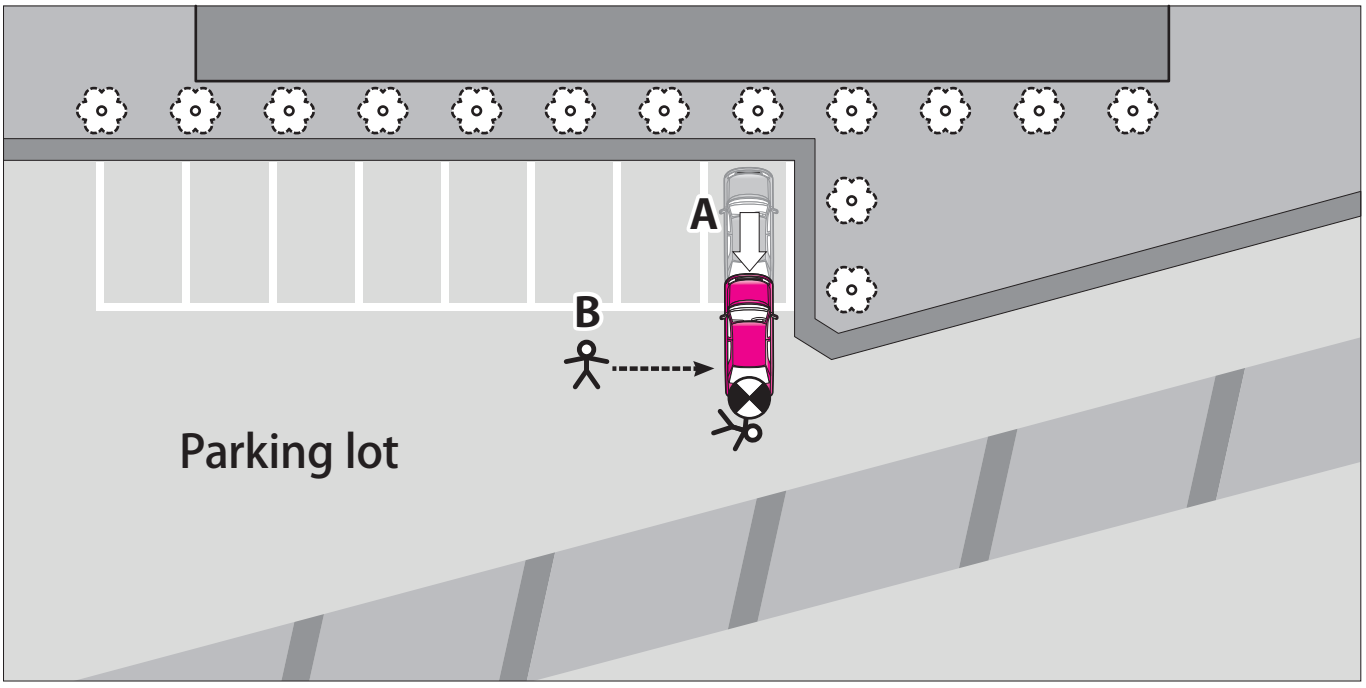


Fig. 9. Reversing accident that occurred because the driver neglected to check behind him

A case example of an accident in which a pedestrian was injured in a reversing accident will be introduced here (Fig. 9). This accident occurred between 8:00 - 9:00 in the morning in the parking lot of some facility. A man in his 60s who was driving a small sized truck (A) went into reverse to pull out of the parking spot in which his truck was parked facing forward. Since the parking lot was deserted, the driver figured that there was nobody around and let his guard down, at which time he began moving in reverse at a speed of approximately 5km/h without checking behind him to see if it was safe. Upon doing so, he failed to notice a 70-year old woman who had been walking from left to right (B), collided with her, and knocked her down. When she fell down on the road's surface, B suffered bruises to her head and face, as well as abrasions to her upper arm. In this case, the pedestrian only suffered slight injuries. However, had the four-wheel vehicle continued traveling in reverse as it was doing, then there is a good possibility that it would have run over the pedestrian, conceivably resulting in a fatal accident or serious injury accident had that been the case.

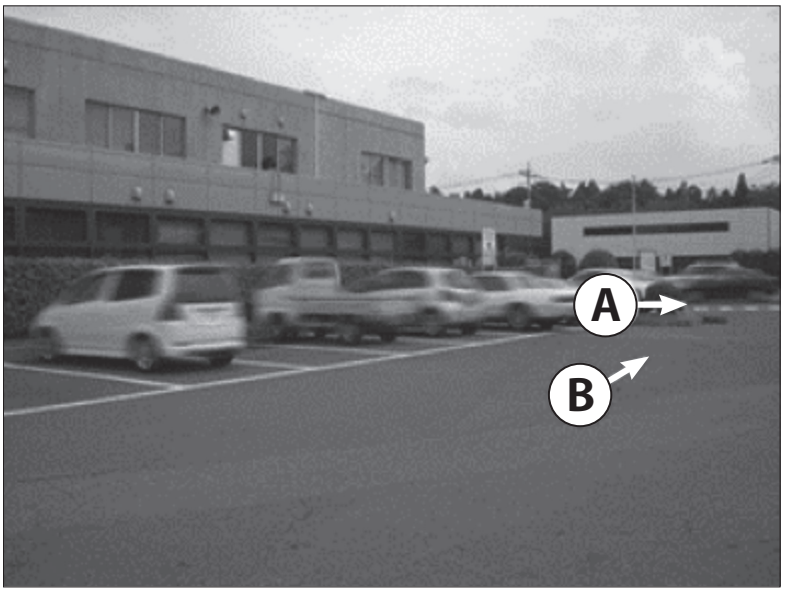


Fig. 10 is a photo of the parking lot that was the scene of the accident. A was reversing out of the innermost parking space, while B was walking from the near side towards the far side, as indicated in the photo.

Fig. 10. The conditions at the scene of the accident

4 Conclusion

The results of this analysis concerning reversing accidents in which four-wheel vehicles collided with vulnerable road users while reversing has revealed the following points.

■ Speed of the reversing vehicle

Reversing accidents frequently occur at relatively low speeds of right around 5km/h.

■ Locations where reversing accidents occur

Pedestrians often get into such accidents while walking within parking lots or in the vicinity around their entrances. Bicycles and motorcycles often get into such accidents while traveling along uninterrupted road section or at intersections (including the vicinity around them).

■ Ages of vulnerable road users injured in reversing accidents

It is mainly elderly people who suffer injuries in those accidents that reach the point of being fatal / serious injury accidents. With slight injury accidents there are many bicyclists and pedestrians from both the young and elderly groups, and while motorcyclists are distributed across a broad age range, it peaks with the young group. On the other hand, contrary to people's preconceived expectations, not that many very young children are injured in such accidents.

■ Ages of the drivers of four-wheel vehicles

There is no age group that could be said to be particularly dangerous, nor particularly safe. Drivers of all ages cause reversing accidents.

As was mentioned at the outset, the composition rate of reversing accidents out of the total number of accidents has continued to increase in recent years, even as the number of such accidents continues to fall. This reveals the increasing need for countermeasures against such accidents. Therefore, a statistical analysis and analysis of cases from the micro-data were performed in order to get an accurate grasp of the actual conditions behind such accidents. The results revealed that reversing accidents mainly involve a youth or older adult suffering injuries when a four-wheel vehicle reverses at a relatively low speed within a parking lot-related facility. In such scenarios, it is highly likely that these accidents could have been avoided if the driver had thoroughly checked to confirm it was safe behind them ahead of time, thereby detecting the presence of the victim. Moreover, if drivers were to park their vehicles by backing into parking spaces, this would oftentimes serve to narrow the range that they must pay attention to when pulling out. Therefore, having people get in the habit of parking in reverse would conceivably be effective for avoiding accidents. Recently, the number of vehicles equipped with back cameras has been on the rise, and so utilizing their functions in addition to one's rearview mirror and side mirrors will be effective when it comes to preventing accidents when reversing. In addition, functions that can detect moving objects and people behind one's vehicle when reversing have recently begun to be put to practical use, with the hope being that such devices will grow increasingly popular.

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