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.125

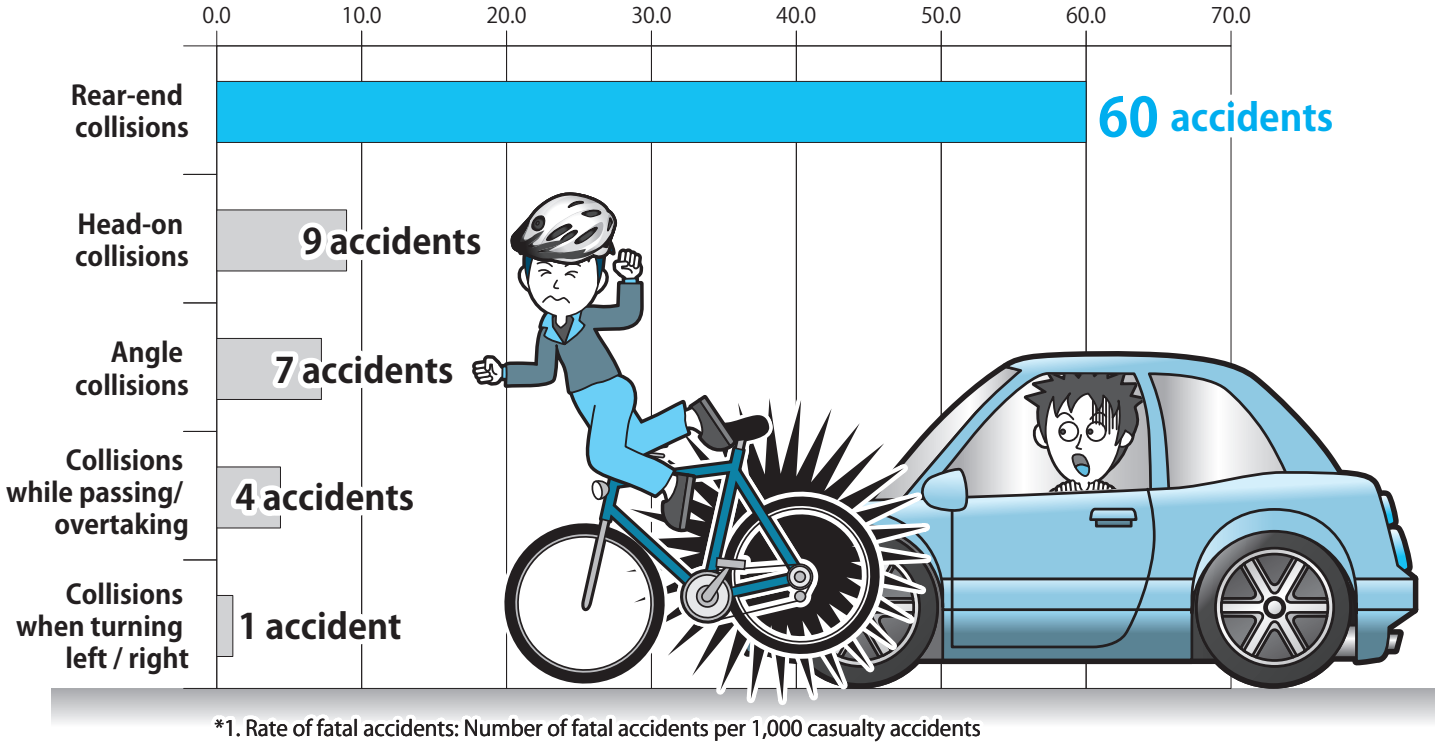
Special feature

Rear-end collision accidents between four-wheel vehicles and bicycles

~ Be careful not to overlook cyclists at night on the left-hand side of the roadway! ~

Number of fatal accidents per 1,000 casualty accidents

Rate of fatal accidents by type of accident between four-wheel vehicles and bicycles that occurred on roadways*1
(Cumulative total from 2012 to 2016)



*1. Rate of fatal accidents: Number of fatal accidents per 1,000 casualty accidents

1 Introduction

In traffic accidents, the involved parties are divided up into the primary party and the secondary party depending on the relative degree of their culpability. The number of accidents that occurred in 2016 in which a passenger car (not including mini-cars) or a truck (hereafter referred to as “four-wheel vehicles”) was involved as the primary party and where the secondary party suffered injuries or death came to 427,111. Of these, 69,631 were accidents in which the secondary party was a cyclist and suffered injuries or death, 258 of which were fatal accidents.
Fig. 1 shows trends since 1997 in the number of accidents in which the primary party was driving a four-wheel vehicle and the secondary party who was a cyclist suffered injuries or death. It reveals that casualty accidents rose moderately between 1997 and 2004, peaked in 2004, and then began trending downwards thereafter. As for fatal accidents, these have been on a mostly downward trajectory since 1997.
A number of factors can be offered as reasons for this decline in the number of accidents between four-wheel vehicles and bicycles, such as the revisions to the Road Traffic Act with respect to bicycle use, improvements to the traffic environment for bicycles, and improvements to the safety performance of vehicles. While these sorts of outcomes persist, what sorts of issues must we focus on in order to continue decreasing the number of accidents between four-wheel vehicles and bicycles in the future? In order to find hints to answering this question, this issue of ITARDA Information No. 125 will take a look at the characteristics of traffic accidents between four-wheel vehicles and bicycles.

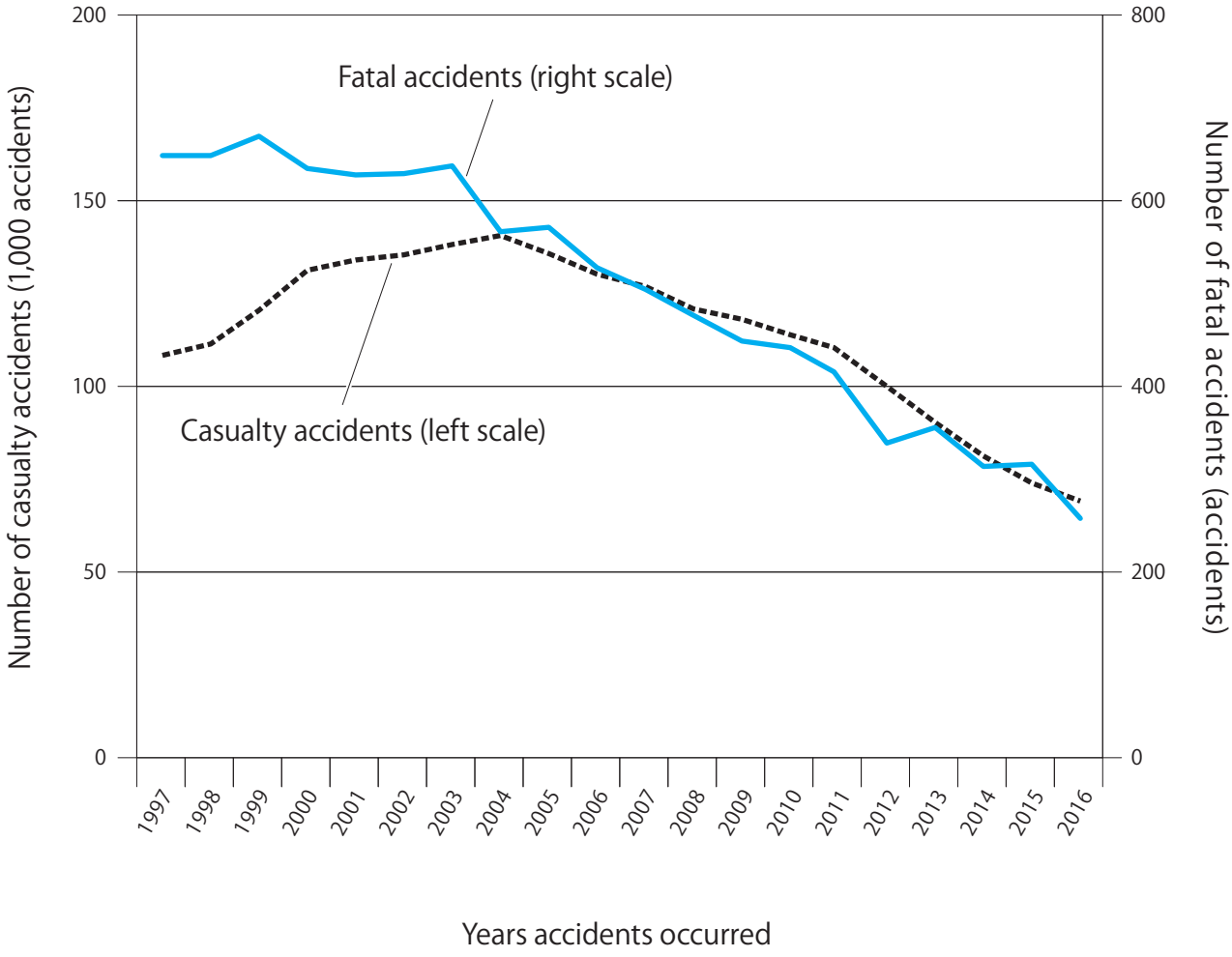


Fig. 1. Trends in the number of accidents between four-wheel vehicles and bicycles

② Locations where accidents between four-wheel vehicles and bicycles occur

In what sorts of locations do accidents between four-wheel vehicles and bicycles occur? The number of accidents hereafter will focus on accidents in which the primary party was driving a four-wheel vehicle and the secondary party was a cyclist and the cyclist either died or was injured. Fig. 2 shows the composition rate by road configurations at locations where casualty accidents between four-wheel vehicles and bicycles occurred in 2016. Fig. 3 shows the composition rate for fatal accidents between the same. Since the number of fatal accidents in Fig. 3 is lower than the number of casualty accidents, the cumulative total for the five years from 2012 to 2016 was used.
Intersections constitute the road configuration where the greatest number of accidents between four-wheel vehicles and bicycles occurred for both casualty accidents and fatal accidents, with these accounting for more than half in both cases. A higher rate of fatal accidents occurred at non-intersections versus casualty accidents.

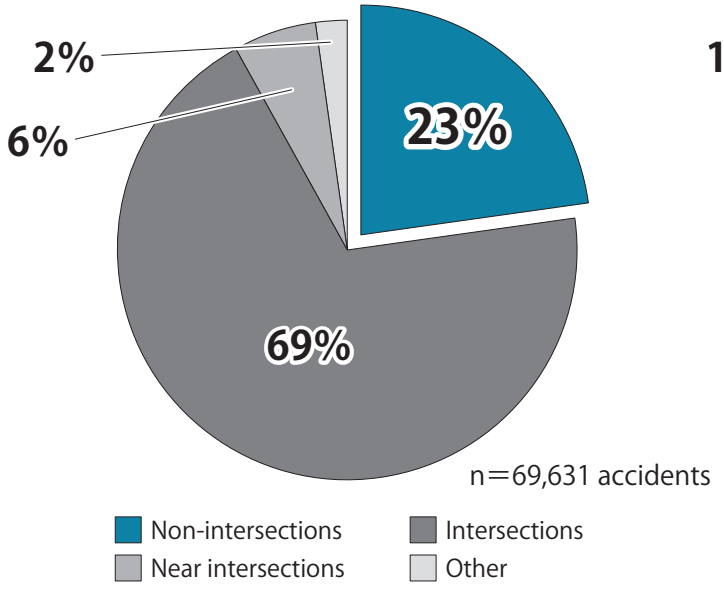


Fig. 2. Composition rate by road configurations for casualty accidents (2016)

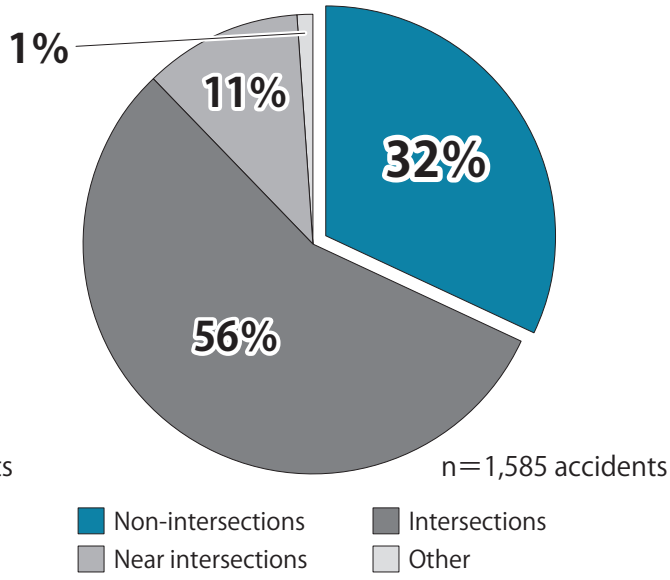


Fig. 3. Composition rate by road configurations for fatal accidents (2012 – 2016)

Let's look at accidents that occurred at non-intersections in a bit more detail. Figs. 4 and 5 shows the composition by collision sites for casualty accidents and fatal accidents between four-wheel vehicles and bicycles that occurred at non-intersections. Roadways accounted for more than half of the collision sites at which casualty accidents occurred at 57%, with sidewalks accounting for 38%. Conversely, an even higher rate of fatal accidents occurred on roadways, with 95% of fatal accidents taking place on roadways.

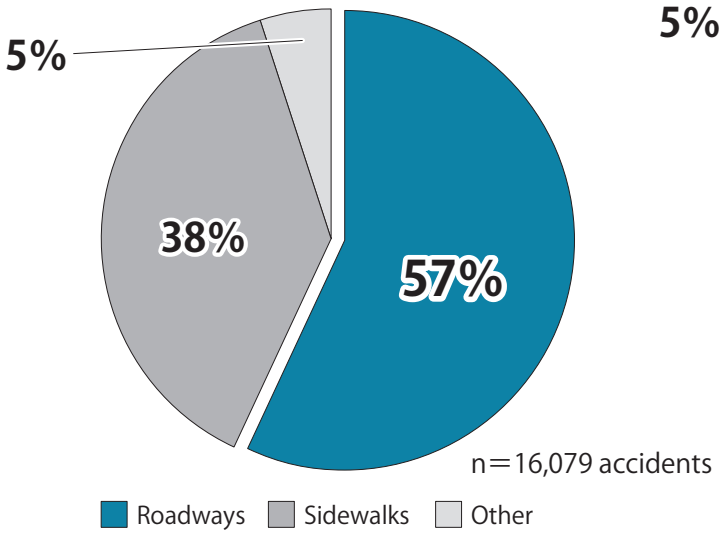


Fig. 4. Composition rate by collision sites for casualty accidents at non-intersections (2016)

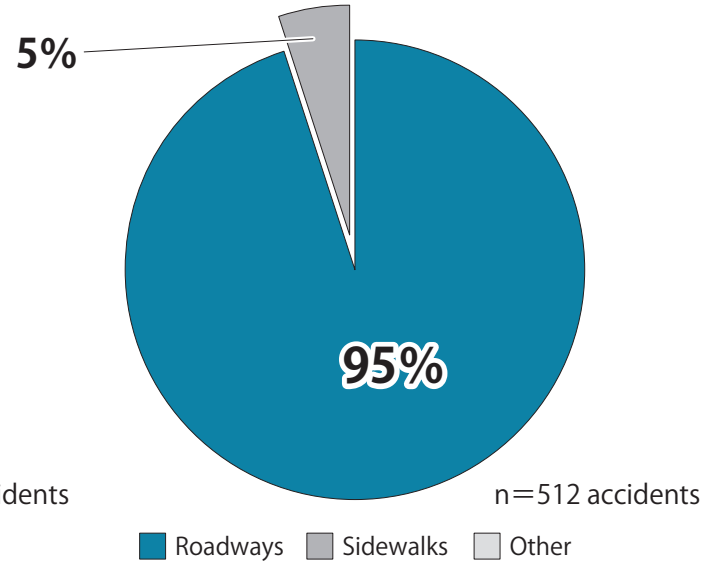


Fig. 5. Composition rate by collision sites for fatal accidents at non-intersections (2012 – 2016)

3 Rear-end collision accidents accounted for most of the fatal accidents, with most of these occurring at night

Most fatal accidents occur on roadways, but what sorts of accidents must the cyclists be cautious of when riding along roadways? Figs. 6 and 7 show the composition rates by type of accident for both casualty accidents and fatal accidents between four-wheel vehicles and bicycles that occurred on roadways. Composition rate for type of accident for casualty accidents indicates that various different accidents occur with relatively no significant inclinations in any direction. Conversely, roughly half of fatal accidents consist of rear-end collision accidents at 48%, with their composition by accident type differing drastically from that for casualty accidents.

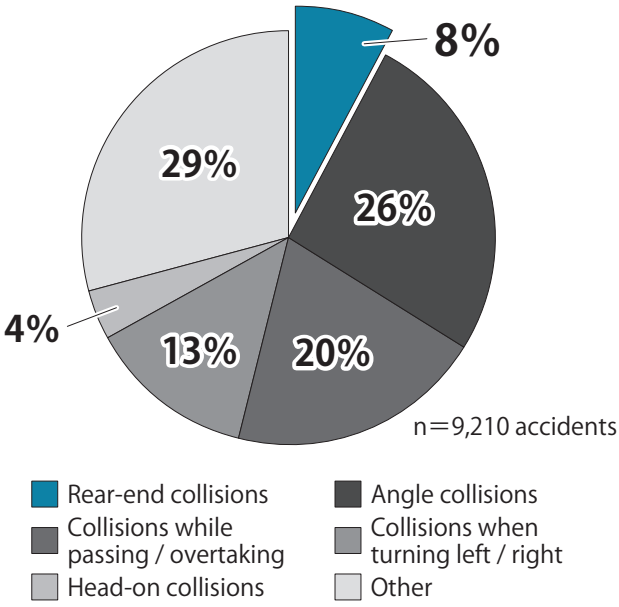


Fig. 6. Composition rate by type of accident for casualty accidents on roadways (2016)

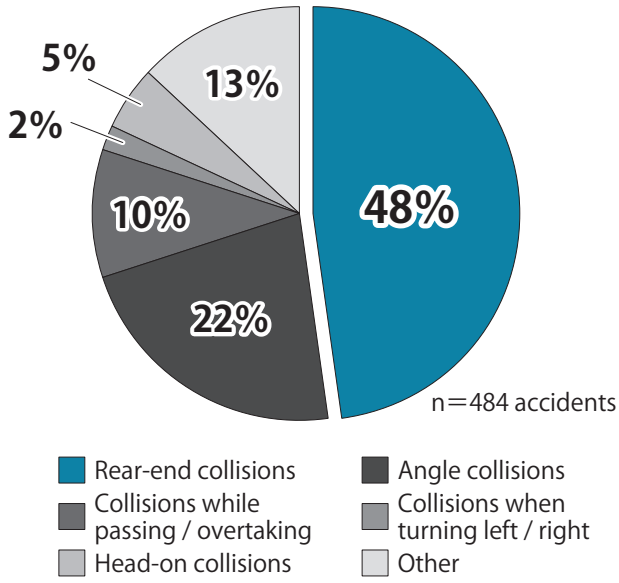


Fig. 7. Composition rate by type of accident for fatal accidents on roadways (2012 – 2016)

Furthermore, the times at which accidents occur were divided up into day and night, with the composition rates for each respective accident type shown in Figs. 8 – 11. Figs. 8 and 9 show the composition rates for the accident types for both casualty accidents that occurred in the day and those that occurred at night. Rear-end collisions account for a low rate of the casualty accidents that occurred during the day at just 5% of the total, but account for 17% of those that occurred at night. Moreover, looking at the composition for accident type for fatal accidents indicated in Figs. 10 and 11 reveals that the rate of rear-end collisions was high both during the day and at night at 30% and 62% respectively.

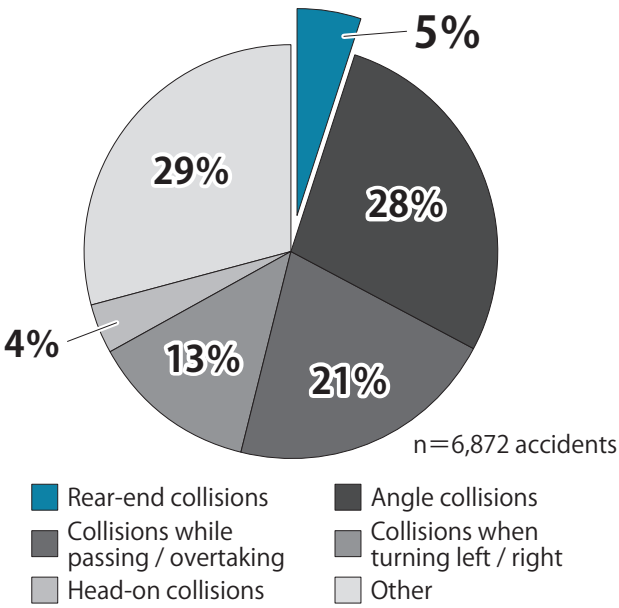


Fig. 8. Composition rate by type of accident for casualty accidents during the day (2016; place of occurrence: roadways)

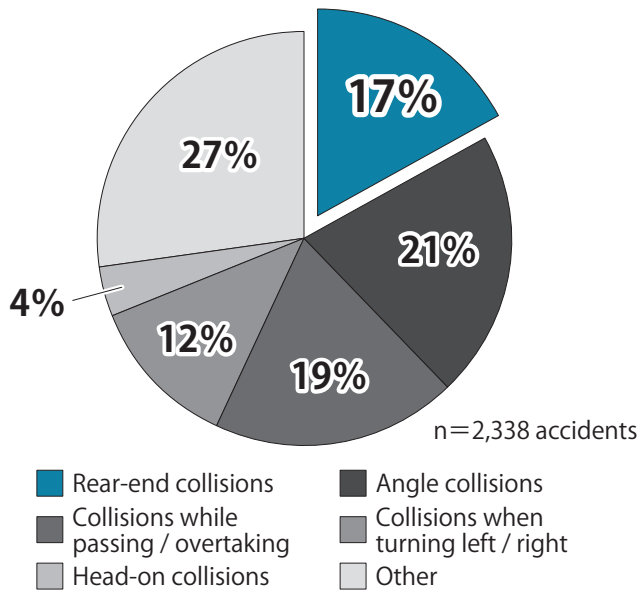


Fig. 9. Composition rate by type of accident for casualty accidents at night (2016; place of occurrence: roadways)

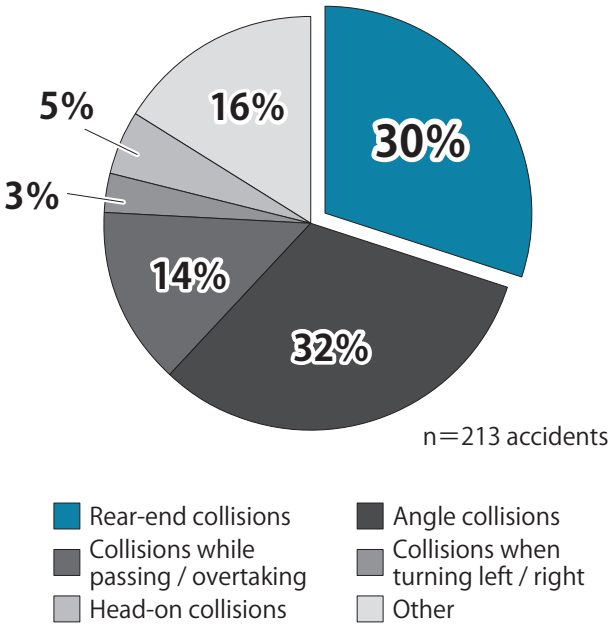


Fig. 10. Composition rate by type of accident for fatal accidents during the day (2012 – 2016; place of occurrence: roadways)

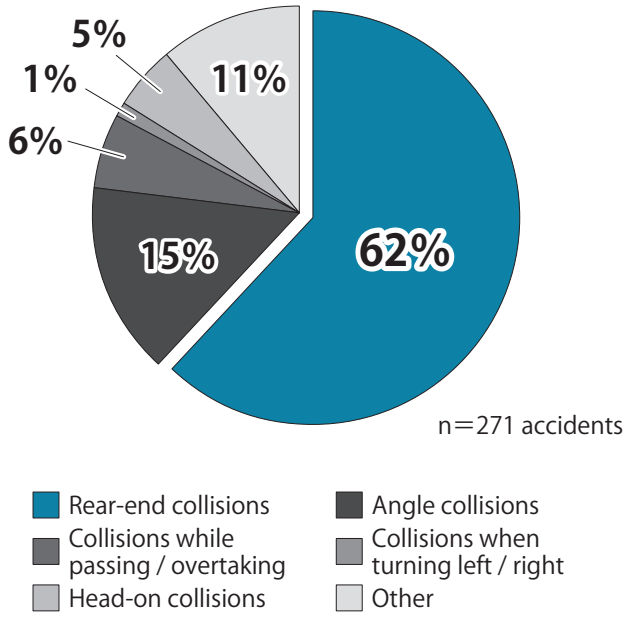


Fig. 11. Composition rate by type of accident for fatal accidents at night (2012 – 2016; place of occurrence: roadways)

4 Why is the rate of fatal accidents from rear-end collision accidents so high?

As we have seen thus far, rear-end collision accidents on roadways account for a high rate of the fatal accidents between four-wheel vehicles and bicycles, with a higher rate of such accidents occurring at night than in the day. Therefore, the question is how dangerous are rear-end collision accidents compared with other types of accidents? Fig. 12 shows the rate of fatal accidents (number of fatal accidents per 1,000 casualty accidents) by accident type between four-wheel vehicles and bicycles that occurred on roadways over the 20-year period between 1997 and 2016. While this fluctuates from year to year, the rate of fatal accidents from rear-end collisions is high on the whole. The rate of fatal accidents from rear-end collisions has hovered between about 50 – 80%, whereas the rate for the types of accidents other than rear-end collisions are below 20%.

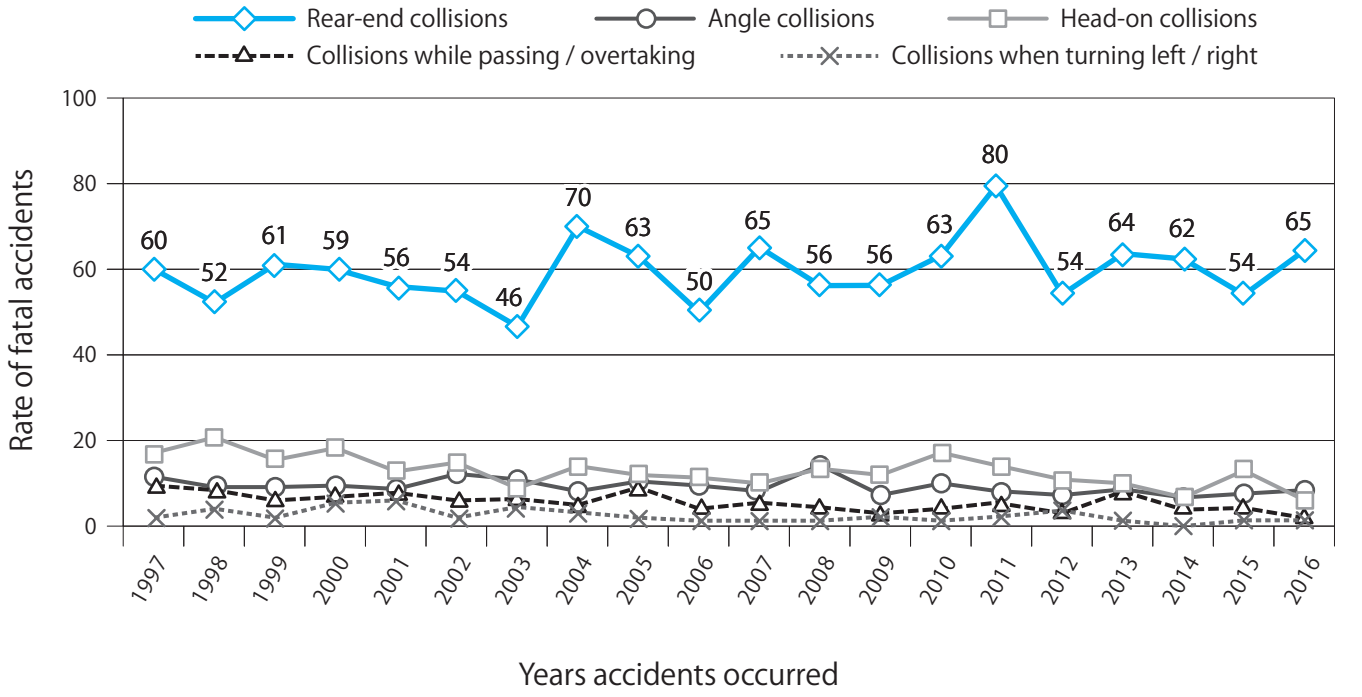


Fig. 12. Rate of fatal accidents between four-wheel vehicles and bicycles that occurred on roadways

Why is the rate of fatal accidents from rear-end collision accidents so high? Fig. 13 show the danger perception speed of four-wheel vehicles by accident type for casualty accidents between four-wheel vehicles and bicycles that occurred on roadways. The danger perception speed for when rear-end collision accidents occurred is higher than with other accident types. Roughly 60% of rear-end collision accidents consist of accidents where the vehicle had exceeded the danger perception speed of 30km/h, with accidents where 50km/h had been exceeded accounting for more than 10%. Rear-end collision accidents are an accident type whereby a four-wheel vehicle collides with a bicycle from behind when both the four-wheel vehicle and bicycle are traveling in the same direction. Therefore, it is conjectured that in most cases accidents occurred because the four-wheel vehicle collided with the bicycle after a delay in detecting them despite being in a position where the bicycle was visible up ahead for some time (this excludes cases where the bicycle suddenly cut directly in front of the four-wheel vehicle). Such cases result in the four-wheel vehicle colliding with the bicycle after failing to reduce their speed by all that much, which is believed to be a factor behind the high rate of fatal accidents from rear-end collisions. Moreover, even in situations where rear-end collision accidents occurred as a result of the bicycle cutting directly in front of the four-wheel vehicle, there is only a brief interval between when danger is perceived and the collision, indicating that the vehicle is still traveling at a high rate of speed.

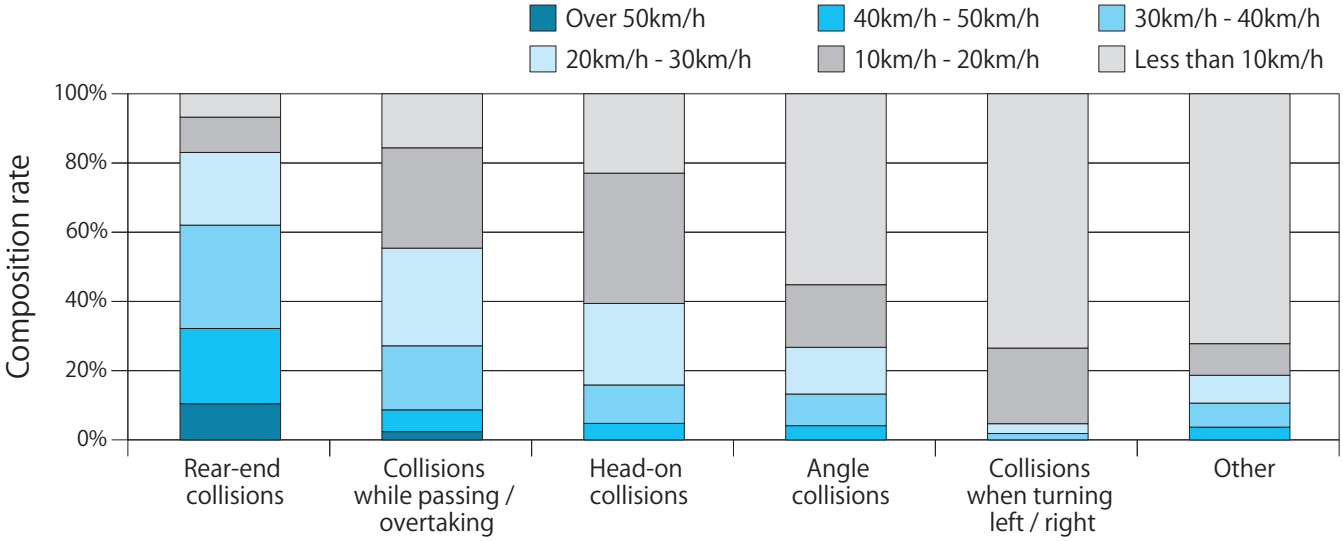


Fig. 13. Composition rates by dangerous perception speed for accidents between four-wheel vehicles and bicycles that occurred on roadways (2016)

Fig. 14 shows the trends in the number of fatal accidents between four-wheel vehicles and bicycles that occurred on roadways each year in the 20 years between 1997 and 2016 for rear-end collision accidents and other types of accidents. In addition, the numbers in the diagram indicate the rate of rear-end collision accidents constituting the total number of fatal accidents. Even though the number of fatal accidents has been falling year by year, the rate of rear-end collision accidents has risen moderately on the whole despite repeatedly fluctuating within a narrow band since 2010. As indicated in Fig. 7, of the cumulative total from 2012 to 2016, rear-end collision accidents accounted for roughly half of the fatal accidents between four-wheel vehicles and bicycles at 48%, accounting for 56% in the single year of 2016. This indicates the immense importance of countering rear-end collision accidents between four-wheel vehicles and bicycles.

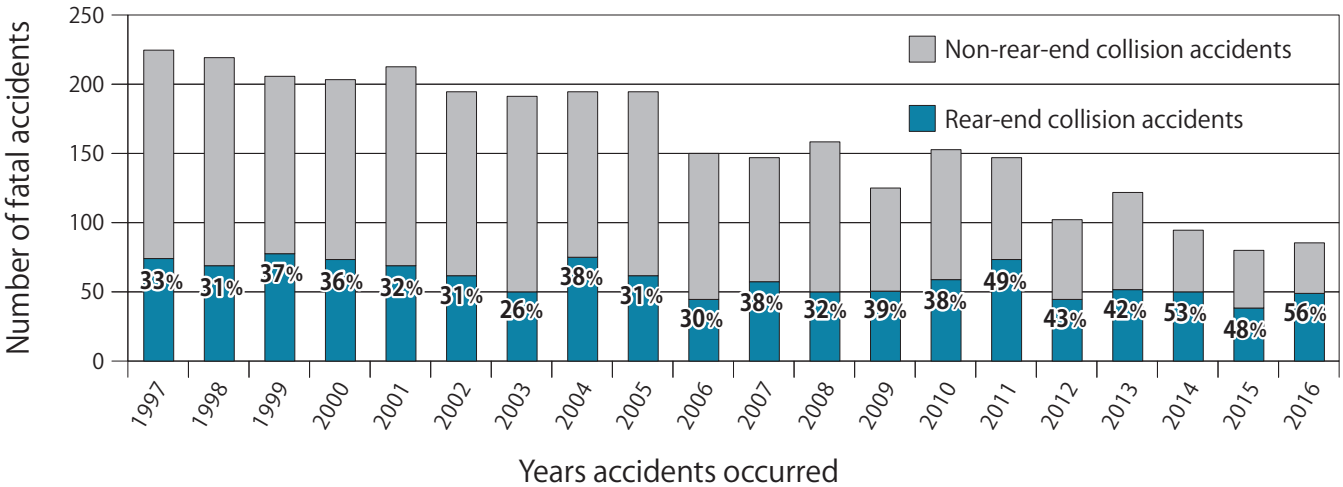


Fig. 14. Number of fatal accidents between four-wheel vehicles and bicycles that occurred on roadways

5 Introduction to case examples of accidents

Two case examples of actual rear-end collisions between four-wheel vehicles and bicycles will be introduced.
The first accident consists of a rear-end collision accident that occurred when the driver failed to notice a bicycle at night. This accident happened in lane one of a roadway with two-lanes in each direction around 23:00 at night. A male in his 30s driving a medium-sized passenger car (A) was on his way home after finishing work. Given the light volume of traffic in the area due to the late hour, he was traveling approximately 70km/h in a section with a 60km/h speed limit. There was a teenage girl traveling by bicycle (B) ahead of A in the same lane. B was returning home from school, and was on her way home from a station close to her house. Despite steadily drawing nearer to B, A failed to detect B because his attention was focused on a traffic signal up ahead and he collided with B without slowing down at all.

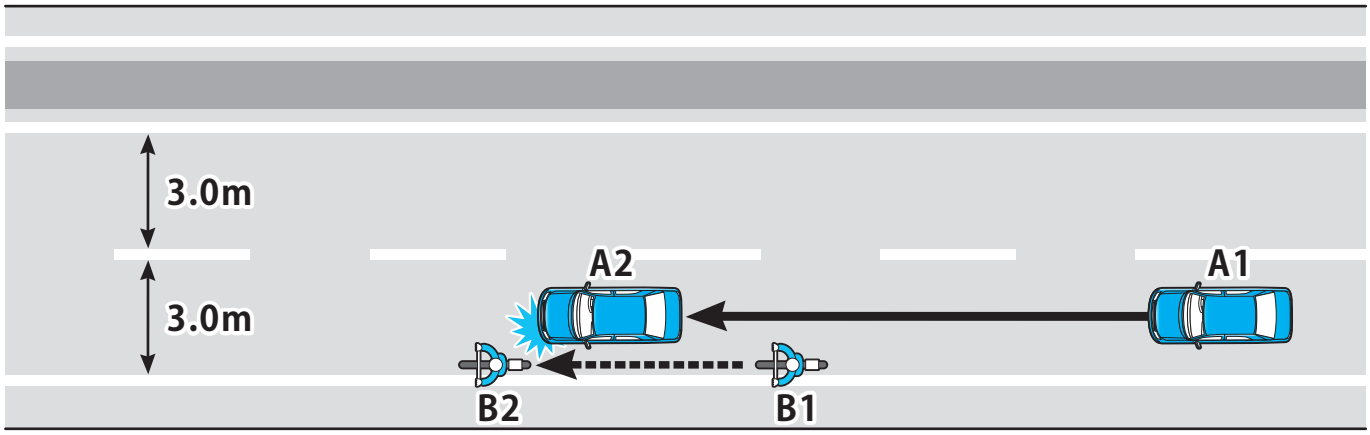


Fig. 15. Rear-end collision accident that occurred because the driver failed to notice a bicycle

The second accident consists of a rear-end collision accident that occurred because the driver failed to respond when the bicycle's path changed. This accident also occurred at night sometime after 22:00 when a light rain was falling. A medium-sized passenger car being driven by a male in his 20s (A) was traveling at approximately 50km/h along a straight road with one-lane in one direction and a speed limit of 40km/h. A was aware of a bicycle being ridden by a woman in her 60s (B) up ahead, but since she was riding in the sidewalk off to the left he continued along without paying her much attention. After a short while, a parcel of private land jutted out from the left, causing the sidewalk to gradually disappear. As a result, B's path slowly moved towards the right as she followed along with the straight line of the road, but A was slow in recognizing that B's path had changed and collided with B.

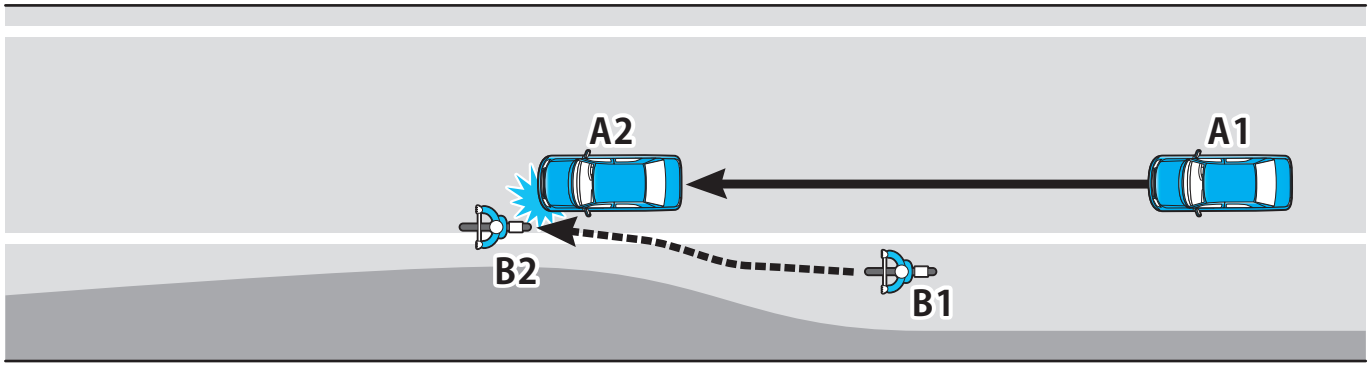


Fig. 16. Rear-end collision accident that occurred because the driver failed to respond when the bicycle's path changed

6 Conclusion

This issue mainly looked at rear-end collision accidents which, out of all of the types of accidents between four-wheel vehicles and bicycles, tend to lead to the most fatal accidents. Rear-end collision accidents often occur when the driver of the four-wheel vehicle fails to notice a bicycle, and therefore this is an accident type that should be handled from the four-wheel vehicle side. Both of the two case examples of accidents introduced occurred at night. In the first case, the driver was delayed in detecting the bicycle because he was preoccupied by the traffic signal up ahead. In the second case, the accident occurred because even though the driver was aware of the bicycle, he failed to respond when the bicycle's path changed. Both of these accident case examples occurred due to a lack of attention being paid to a bicycle traveling in front of the driver.

While the number of fatal accidents between four-wheel vehicles and bicycles continues to fall in and of itself, the rate of rear-end collision accidents of the fatal accidents that occur on roadways has been trending upwards year by year. For this reason, countermeasures against rear-end collisions between four-wheel vehicles and bicycles are growing more important with each passing year. The regulations in the Road Traffic Act state that bicycles are to travel on the left side of roadways as a general rule, and so people frequently encounter bicycles being ridden to the left of roadways when driving automobiles. In order to enable bicycles to travel safely along roadways, we must respond to illegally-parked four-wheel vehicles that pose an obstacle to them. Furthermore, over the medium to long-term we should ideally also improve the traffic environment for bicycles, including bicycle lanes and other measures.

Seen from the perspective of four-wheel vehicles, bicycles are vulnerable road users. When driving four-wheel vehicles, drivers must work to ensure that they drive safely when they detect bicycles traveling along. Such efforts include paying attention to the bicycle's movements and, when passing or overtaking them, maintaining as much distance between the bicycle as possible and reducing their speed to one that is appropriate considering this distance when overtaking them.

On the other side, when it comes to measures to prevent accidents from the bicycle's side, bicycles are treated as a type of vehicle and granted the right to travel on roadways. In other words, cyclists must abide by traffic signals and instructions to stop, as well as travel by obeying other traffic signs and traffic rules. On top of this, to effectively respond to the rear-end collision accidents covered in this issue, an approach that is considered to be effective even at night, when visibility is poor, is for cyclists to equip themselves with equipment that emits light even without having the headlights from four-wheel vehicles shined on them. Examples of this include using reflective materials or installing LED tail lights in order to alert drivers to their presence.

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