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（財）交通事故総合分析センター
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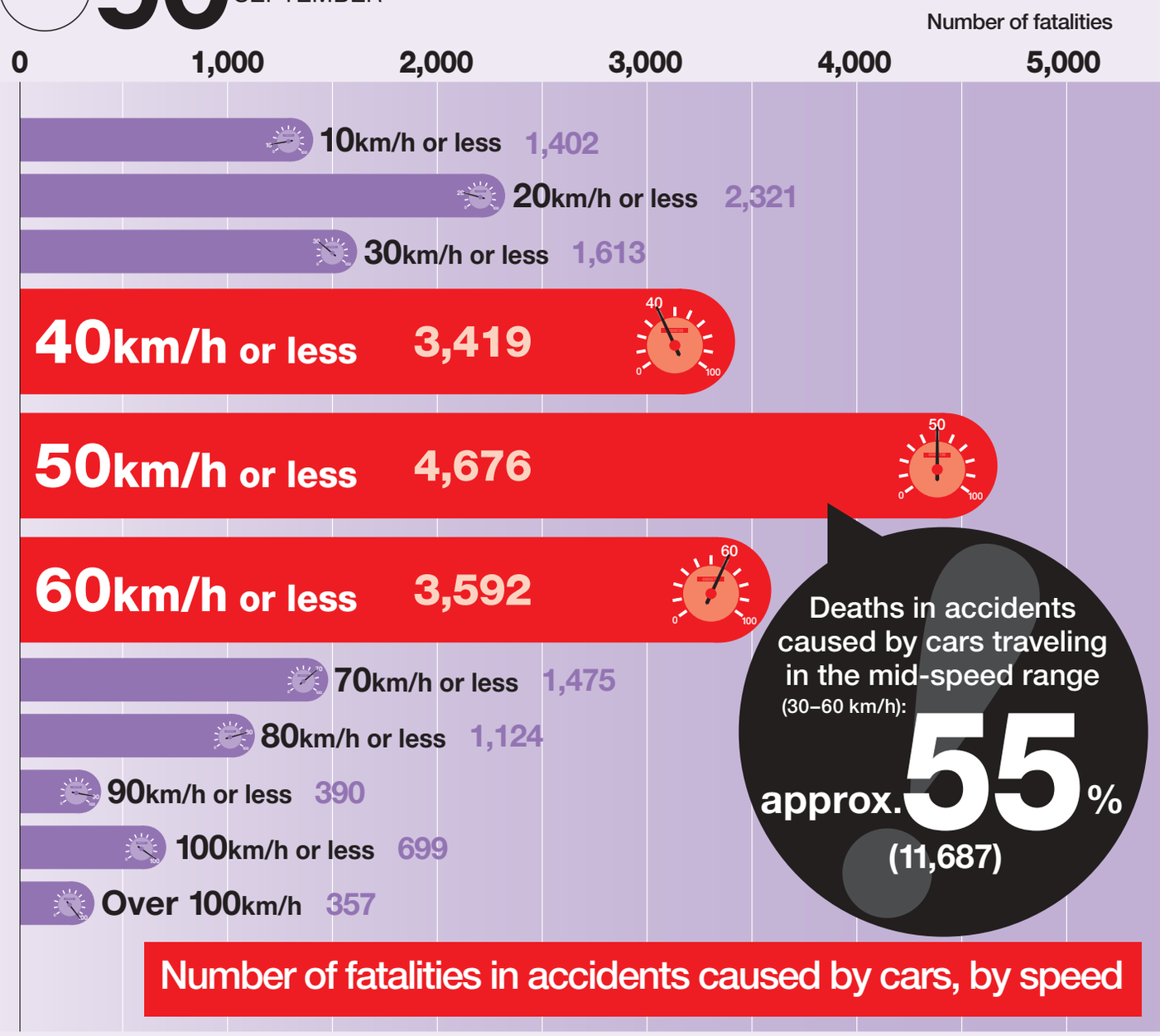

Number of fatalities in accidents caused by cars, by speed

Special feature

Fatal accidents are caused more frequently in the mid-speed range

—by drivers being inattentive or distracted—

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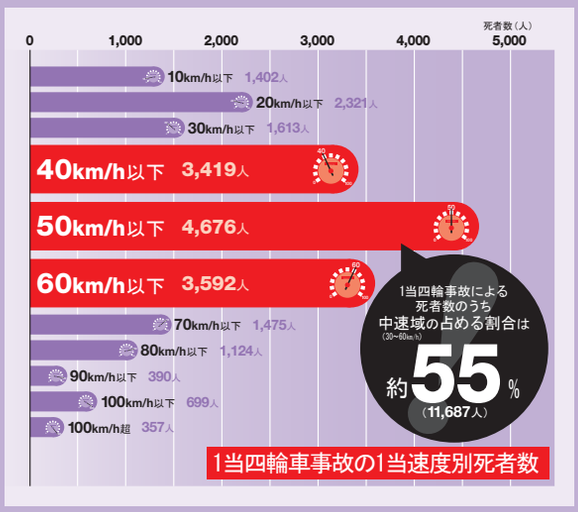


Special feature

Driving in the mid-speed range causes more fatal accidents
— by drivers being inattentive or distracted —

The annual death toll of all traffic accidents in Japan (those who died within 24 hours following the accident) has fallen by more than half over the last 10 years, with 4,863 deaths in 2010. However, this downward trend has slowed in the last few years, and as many as 896,208 people were still injured in that year. Accidents are mainly caused by four-wheeled vehicles (hereafter “cars”) involving pedestrians or other cars and are also caused on their own. It is therefore important to take measures to further reduce car-related accidents.

One of the major factors in car-related accidents is speed. It may seem that higher car speeds would increase the risk and severity of accidents, but this is not always the case. For this issue of ITARDA Information, we explored the characteristics of traffic accidents focusing on car speeds, and found that fatal accidents were most often caused at speeds between 30 and 60 km/h (hereafter “mid-speed range”). We also found that many drivers were inattentive or distracted at the time of the accident. Here, we look at why drivers tend to become inattentive or distracted more easily while driving in the mid-speed range.

CONTENTS

SECTION 1

Fatal car accidents in terms of traveling speed

(1) High number of fatalities in accidents involving cars traveling in the mid-speed range

Table 1 and Figure 1 show the number of fatalities involved in accidents in which the primary party was a car (including primary party deaths) according to the primary party's danger recognition speed and the victim's means of transportation. (Each figure is the total of such fatalities recorded between 2006 and 2010.)
The danger recognition speed refers to the speed at which the driver noticed another vehicle, a pedestrian, or other objects and recognized the impending danger. It is used as the traveling speed of the car in this analysis.
Many of these fatalities, or about 60%, were caused when the car as the primary party was traveling in the mid-speed range (30 to 60 km/h). Specifically, two categories, i.e., those killed while "walking" and "riding in a car" make up a large proportion, or about 80% collectively, followed by those killed while "riding a bicycle" accounting for about 10%.

Table 1: Number of fatalities by speed and means of transportation in accidents involving cars as the primary party [Total between 2006 and 2010]

Car's danger recognition speed	Riding in a car	Walking	Riding a bicycle	Riding a motorcycle	Total
-0km/h	278	538	197	389	1,402
-20km/h	539	789	393	600	2,321
-30km/h	520	611	256	226	1,613
-40km/h	1,166	1,625	434	194	3,419
-50km/h	1,802	2,134	543	197	4,676
-60km/h	1,603	1,456	388	145	3,592
-70km/h	766	501	141	67	1,475
-80km/h	809	214	72	29	1,124
-90km/h	300	60	16	14	390
-100km/h	606	52	14	27	699
Over 100km/h	335	17	1	4	357
Total	8,724	7,997	2,455	1,892	21,068

(Including primary party deaths and 905 deaths on freeways)

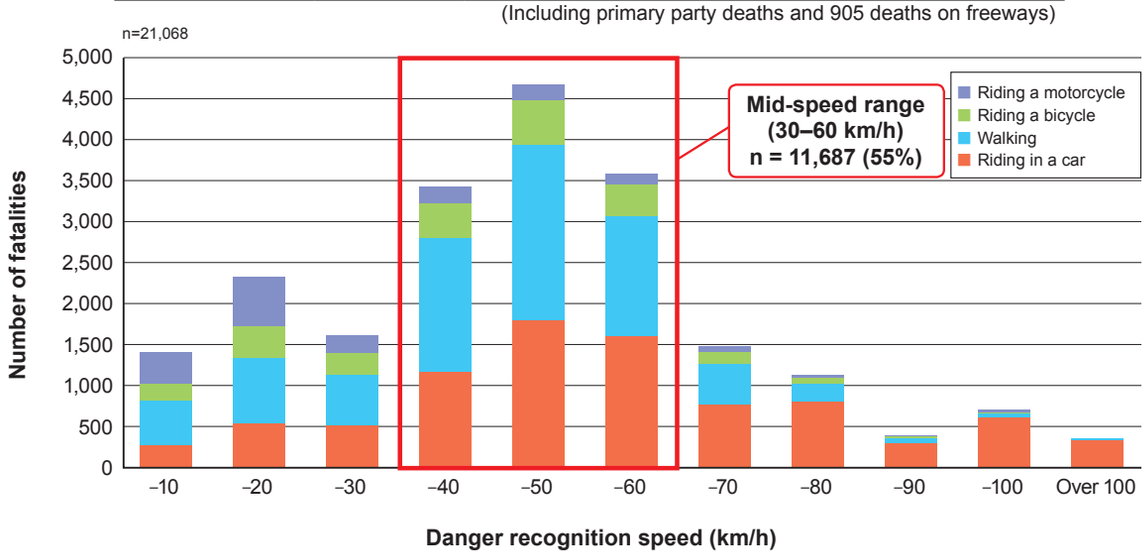


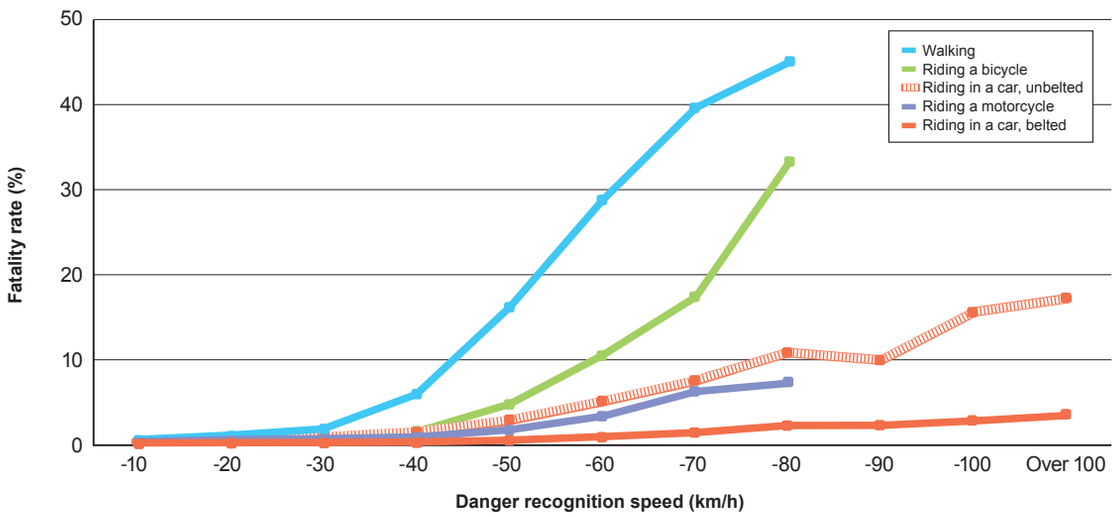
Fig. 1: Number of fatalities by speed and means of transportation in accidents involving cars as the primary party [Total between 2006 and 2010]
(Including primary party deaths and 905 deaths on freeways)

(2) Higher speeds significantly increase the fatality rates

By how much do higher speeds increase the risk of fatal accidents? Figure 2 shows the fatality rate according to the primary party's car speed and by the victim's means of transportation.
The fatality rate refers to the proportion of those killed in traffic accidents in relation to the total number of casualties, defined by the following formula:

$$\text{Fatality rate} = \frac{\text{Number of fatalities}}{\text{Number of casualties}} \times 100\ (\%)$$

The higher the car speed, the higher the fatality rate of traffic accidents regardless of the means of transportation, indicating a relationship between a faster car speed and a greater risk of death. Among the several means of transportation, "walking" has the highest fatality rate, followed by bicycles. These two rates in particular show a rapid rise as the primary party's car speed exceeds 30 km/h. Thus, cars traveling even in the mid-speed range can kill a pedestrian or bicyclist more easily than expected.
The fatality rate for car drivers is shown separately for those who were wearing a seat belt and those who were not. Unbelted drivers have a 4 to 5 times higher risk of death compared to belted drivers, and this difference becomes even wider at higher car speed. This clearly shows the importance of wearing a seat belt while in a car for reducing the damage in an accident.



* Excluding the rates for pedestrians, bicyclists and motorcycle riders for car speeds over 80 km/h because of a small number of casualties
* Excluding drivers whose use of a seat belt is not known

Fig. 2: Fatality rate by primary party's car speed and by means of transportation
[Calculated based on the total between 2006 and 2010]

SECTION 2

Characteristics of fatal accidents caused when driving in the mid-speed range

In traffic accidents involving cars, the previous section showed that the fatality rates rise with higher car speed, but the number of fatalities itself is highest for accidents caused by cars traveling in the mid-speed range. What kinds of accidents are typically caused and why do they occur more frequently in this speed range?

Let's examine the accident data more closely by looking at car-to-car, single-car and car-to-pedestrian accidents, being major categories with a large number of fatalities, and car-to-bicycle accidents, a category with a somewhat different tendency.

(1) Fatal car-to-car and single-car accidents

■ Head-on collisions are more likely to occur in the daytime

Figure 3 shows the number of fatalities in car-to-car and single-car accidents according to the type of accident, represented separately in two graphs to compare the characteristics between those occurring in the daytime and those at nighttime. We can see that fatal accidents generally occur more frequently in the daytime and when the car is traveling in the mid-speed range, especially head-on collisions with another car. At nighttime, a noticeably high percentage of drivers are killed by crashing into roadside structures at high speed.

■ Inattentive/distracted driving are the major causes of accidents in the mid-speed range

What factors cause head-on collisions in the daytime while driving in the mid-speed range? Human errors committed by the primary parties that led to accidents are broken down in Fig. 4 by car speed. It is clear that inattentive driving and distracted driving are dominant for the mid-speed range of 30 to 60 km/h.

(Note)
- Inattentive driving (intrinsic factor):
  One factor in the failure to look ahead carefully that is intrinsic to the driver (lowered concentration), including dozing
- Distracted driving (extrinsic factor):
  One factor in the failure to look ahead carefully that is extrinsic to the driver (any behavior or operation unrelated to driving)

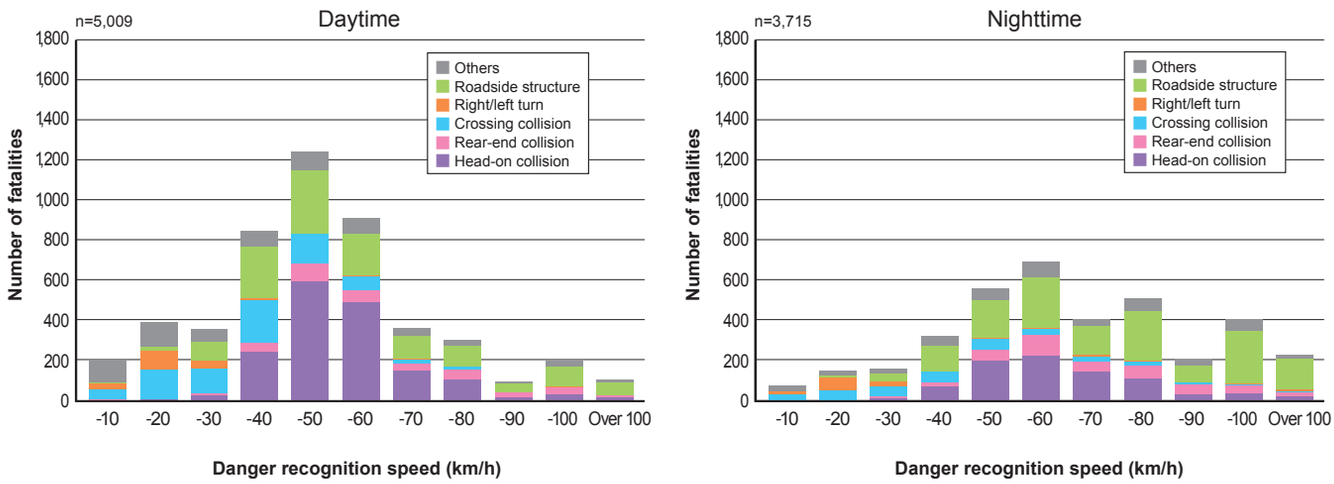


Fig. 3: Number of car driver fatalities by type of accident [Total between 2006 and 2010]

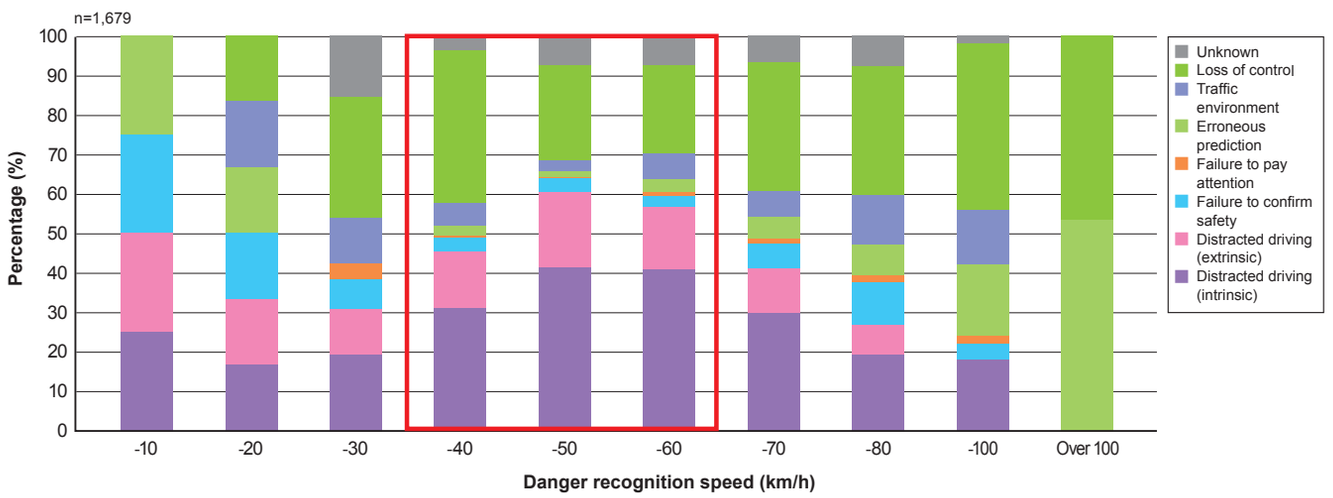


Fig. 4: Human errors in accidents involving cars, by primary party's car speed
(head-on collisions in the daytime) [Calculated based on the total between 2006 and 2010]

(2) Fatal car-to-pedestrian accidents

■ Accidents occur more frequently at nighttime while crossing a road

Figure 5 shows the number of pedestrians killed in traffic accidents caused by cars as the primary party according to the pedestrian's behavior. Pedestrians are clearly exposed to a higher risk of fatal accidents at nighttime caused by cars traveling in the mid-speed range, nearly four times greater than in the daytime. Most of these pedestrians were crossing the road at the time of the accident.

■ Inattentive/distracted driving are also the major causes of nighttime accidents involving pedestrians

Figure 6 shows human errors committed by the primary parties that led to nighttime accidents involving pedestrians who were crossing the road, for different car speeds. It is clear that inattentive driving and distracted driving occupy a large part in the mid-speed range of 30 to 60 km/h. In accidents involving pedestrians, distracted driving constitutes a slightly larger portion than in the case of car-to-car and single-car accidents.

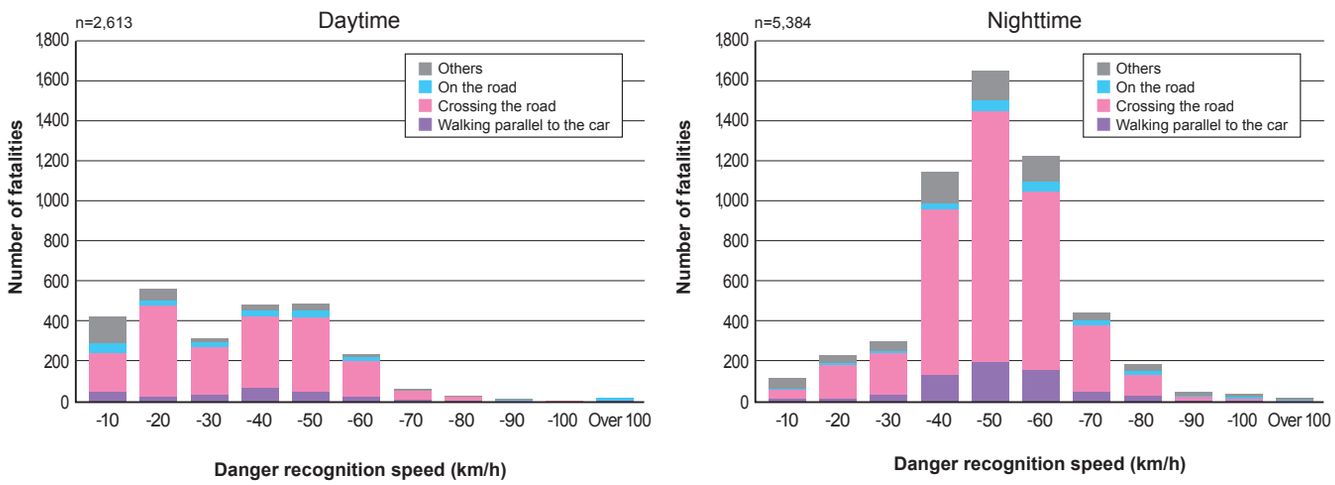


Fig. 5: Number of fatalities in accidents involving cars and pedestrians, by pedestrian behavior
[Total between 2006 and 2010]

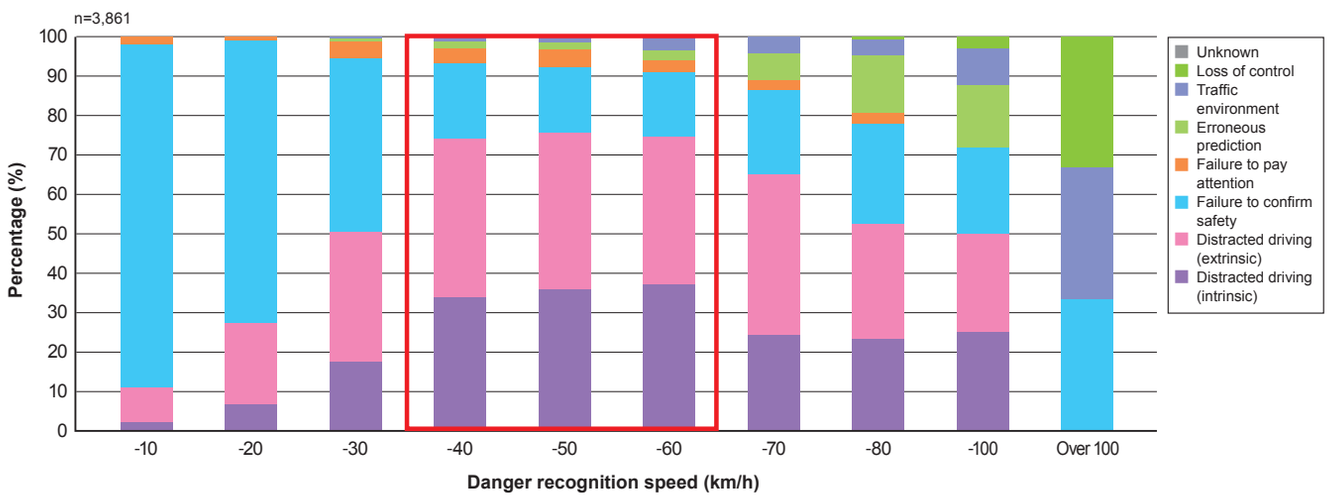


Fig. 6: Human errors in accidents involving pedestrians, by primary party's car speed
(crossing the road at nighttime) [Calculated based on the total between 2006 and 2010]

(3) Fatal car-to-bicycle accidents

Crossing collisions are more common

Fatal accidents involving bicycles have a somewhat different tendency compared to that of car-to-car accidents. Figure 7 shows the number of fatalities in accidents involving bicycles caused by cars as the primary party, by accident type. These accidents occur more frequently in the daytime for the mid-speed range, with most of them being crossing collisions.

In addition, bicyclists are most likely to be killed by cars turning right/left at a speed under 20 km/h in the daytime. Other characteristics include more frequent fatal rear-end collisions at medium car speeds occurring at nighttime than in the daytime.

Inattentive/distracted driving are also the major causes of crossing collisions with bicycles

For crossing collisions with bicycles in the mid-speed range occurring in the daytime, human errors committed by the primary parties are examined for different car speeds, as broken down in Fig. 8. “Failure to confirm safety” tends to be the major factor for many of the speed categories, probably because there are more cases of collisions at intersections than those discussed in the previous section. In the mid-speed range between 30 and 60 km/h, inattentive driving and distracted driving represent high percentages in crossing collisions with bicycles.

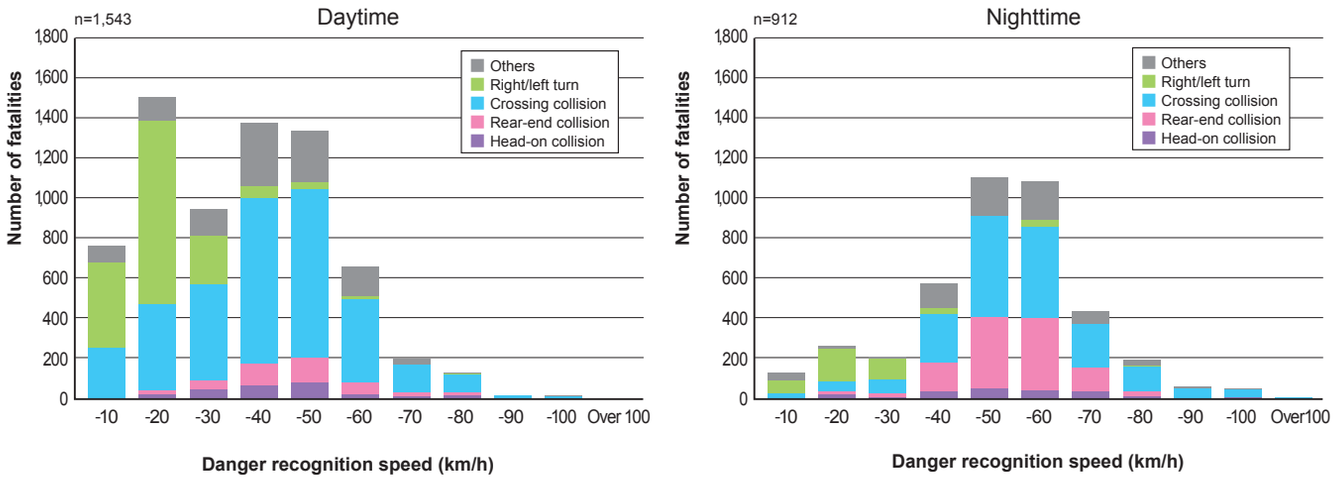


Fig. 7: Number of fatalities in accidents involving cars and bicyclists, by type of accident
[Total between 2006 and 2010]

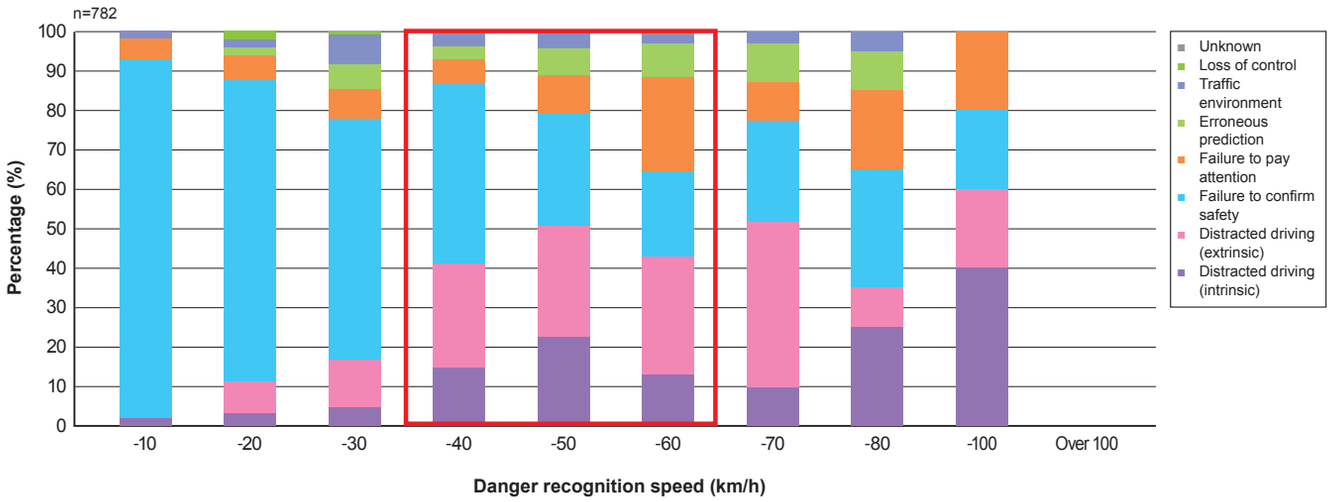


Fig. 8: Human errors in accidents involving bicyclists, by primary party’s car speed
(crossing collisions in the daytime) [Calculated based on the total between 2006 and 2010]

SECTION 3

Characteristics of fatal accidents caused due to inattentive/distracted driving

From the analysis in the preceding sections, inattentive driving and distracted driving are the common major causes of fatal accidents caused by cars traveling in the mid-speed range between 30 and 60 km/h, regardless of the accident type. In what situations do car drivers tend to become inattentive or distracted? Let's explore the characteristics of fatal accidents caused as a result of drivers being inattentive or distracted.

(1) Shortly before sunrise and shortly after sunset

For fatal accidents in which a car is the primary party, the number of those caused by inattentiveness or distraction and the number of those caused by other human errors are compared in Fig. 9 according to the time when the accident occurred. Accidents resulting from inattentive or distracted driving occur most frequently between 6 and 8 p.m., shortly after sunset. There is another peak at 4 to 6 a.m., the time when there is no such peak for accidents caused by other human factors. This may be due to reduced visibility at dawn/dusk combined with inattentive/distracted driving.

(2) Straight road with no intersections

Figure 10 compares fatal accidents caused by inattentiveness or distraction and those caused by other human errors in terms of road type. Inattentive/distracted driving occurs more frequently on straight stretches of road with no intersections, compared to the case of other human factors. Driving on a straight section of road where there are no intersections is relatively simple and requires minimum driving operations, which decreases the driver's concentration and possibly leads to inattentive or distracted driving, which may result in an accident due to a delay in noticing another car, pedestrian or object.

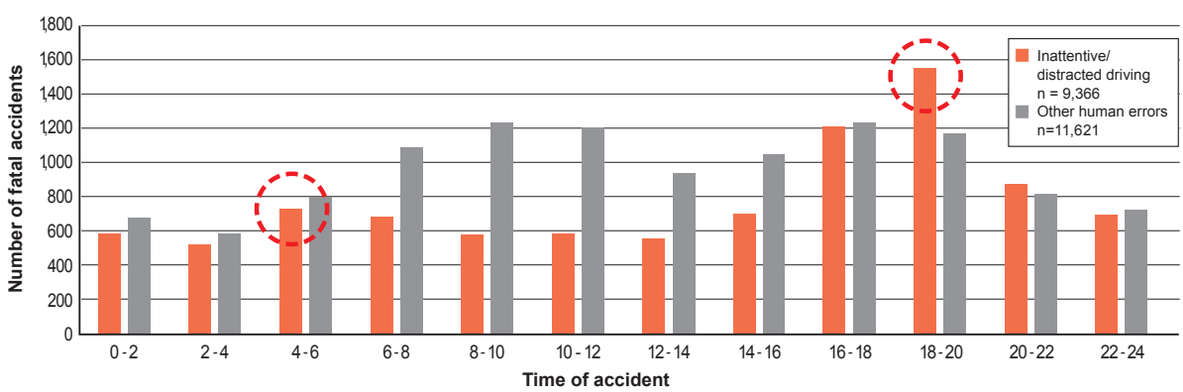


Fig. 9: Number of fatal accidents caused due to inattentive/distracted driving, by time of occurrence
(involving cars as the primary party) [Calculated based on the total between 2006 and 2010]

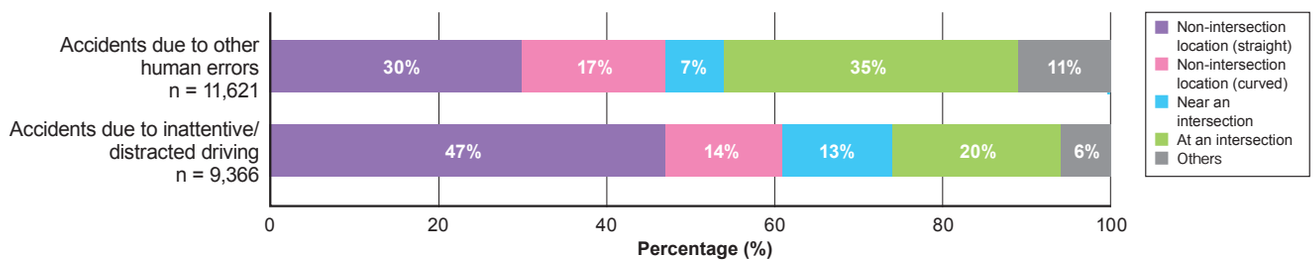


Fig. 10: Type of road in accidents caused due to inattentive/distracted driving and other human errors
(involving cars as the primary party) [Calculated based on the total between 2006 and 2010]

SECTION 4

Causative factors in inattentive/distracted driving

What factors could cause inattentive or distracted driving seen frequently while driving in the mid-speed range of 30 to 60 km/h? Let's explore the causative factors using ITARDA's in-depth study database.

From the 218 head-on collisions between two cars on a section of road without intersections, which is a major type of fatal accident involving cars, 24 cases were selected in which the car was traveling in the mid-speed range and the cause of the accident was the driver being inattentive or distracted, in order to extract causative factors from the accident descriptions and other relevant data. These factors are summarized in Table 2.

Causative factors in inattentiveness, or lowered concentration, include absentmindedness and thinking about something else.

Causative factors in distracted driving are categorized as "operation or behavior unrelated to driving", "dealing with incidents in the car" and "staring at something outside the car". The main cause is "operation or behavior unrelated to driving", with the driver often doing various other things while knowing the danger of taking their gaze off the road. Since looking elsewhere even for just a brief moment can lead to an accident, you should never do other things until the car has stopped. Actions such as "taking out/putting back an item" and "sudden movement of a bag" can be dealt with by, for example, making sure that your bag and other items are firmly secured before starting to drive.

Other common distracting actions include staring at a bicycle or motorcycle you are going to overtake, which keeps your eyes away from what is happening ahead.

Table 2: Number of head-on collisions by causative factors in inattentive/distracted driving
(based on ITARDA's in-depth study database)

Category	Causative factor	Action/object	Number of accidents
Inattentive driving	Absentmindedness	—	3
	Thinking about something else	—	2
Distracted driving	Operation or behavior unrelated to driving	Adjusting the in-car stereo system	3
		Taking out/lighting a cigarette	2
		Taking out/putting back an item	2
		Looking at maps	1
		Looking at passengers	1
	Dealing with incidents in the car	Sudden movement of a bag	3
		Passengers (children in the rear seats)	1
	Staring at something outside the car	Bicycle/motorcycle to be overtaken	5
		Houses	1
		Total	24

[Cases covered: Daytime, at a non-intersection location, primary party's danger recognition speed or speed immediately before accident being 30–60 km/h]

SECTION 5

Examples of accidents

Lastly, described below are two examples of accidents caused by cars traveling in the mid-speed range, taken from our in-depth study database.

Case 1: Head-on collision caused due to distracted driving

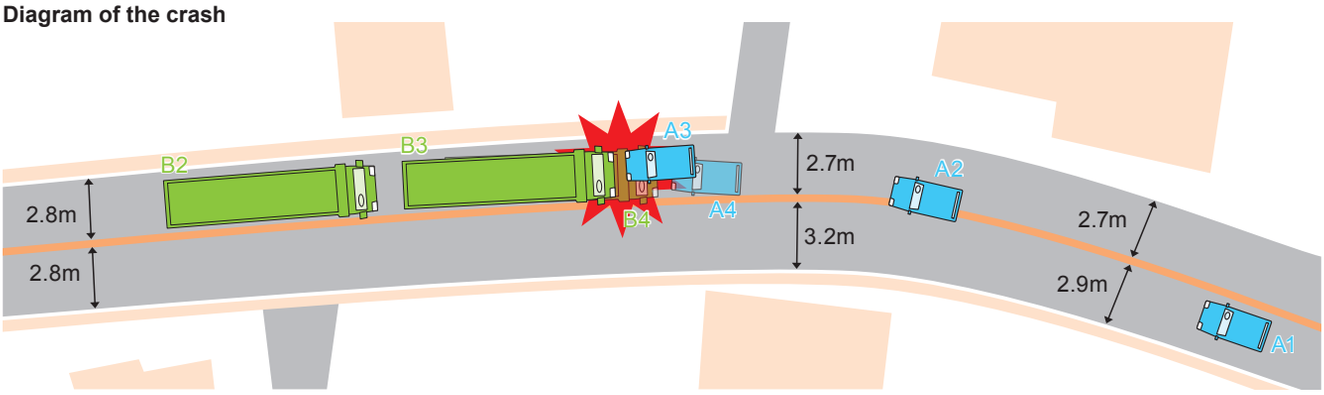
【Situation】

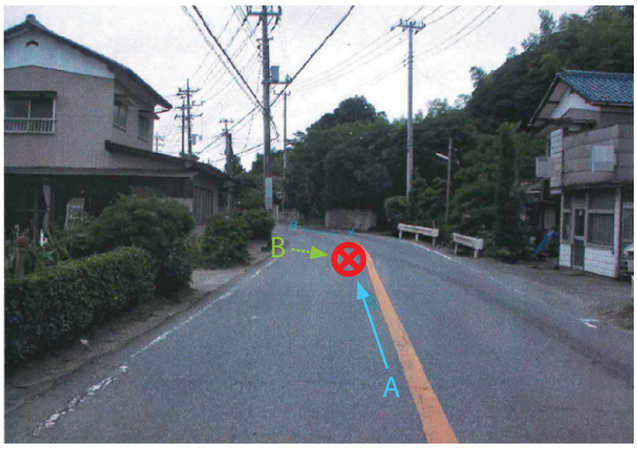
On a sunny day at around noon, a man in his 50s was driving a standard-sized car (A) at about 50 to 60 km/h on his way home from the hospital on a straight section of a two-lane road where overtaking is prohibited. He noticed that his medicine was on the passenger seat, and he wanted to put it in the glove compartment as he usually did. Keeping his right hand on the wheel, he opened the glove compartment with his left hand, holding the medicine at the same time in order to put it in the glove compartment, assuming that the road would continue straight ahead.

Contrary to his assumption, however, the road gently curved to the left. After looking aside for only a moment, he noticed a large truck (B) just 2 to 3 meters ahead in the opposite lane. He tried to slam on the brakes but ended up colliding with the truck.

The man sustained severe injuries in this accident. Remember that only a moment of inattentiveness can lead to a serious accident.

Diagram of the crash





Accident site seen from 50 meters away
The driver took his eyes off the road to put his medicine in the glove compartment, assuming that the road would continue straight ahead.

Accident site
The driver noticed an oncoming truck when the car entered the opposite lane, but it was too late and the car crashed head-on into the truck.

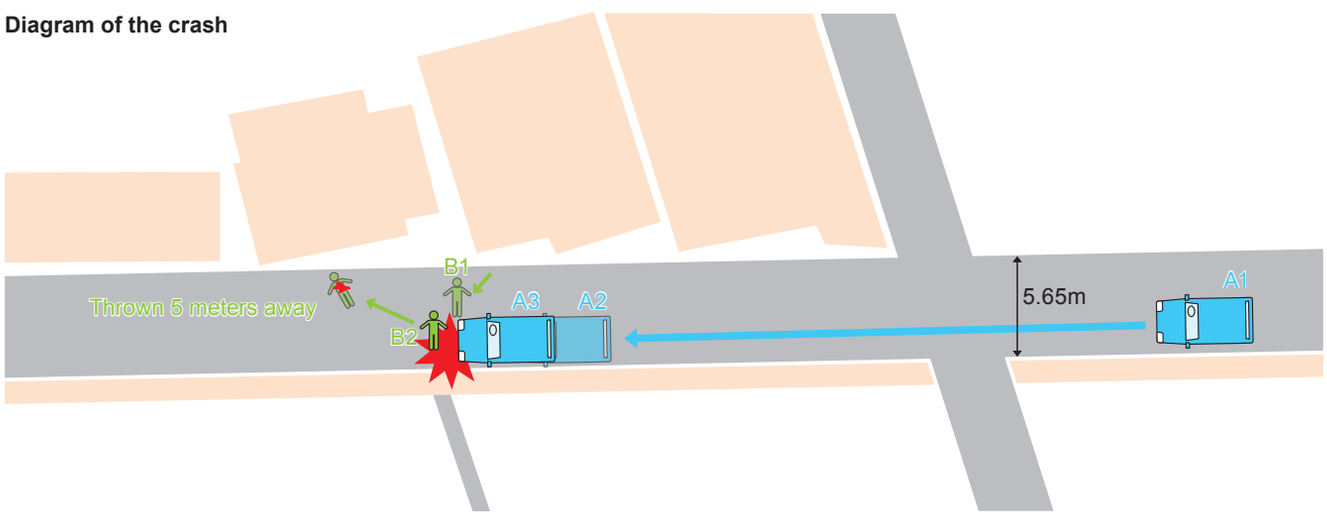
Case 2: Accident involving a pedestrian caused due to inattentive driving

【Situation】

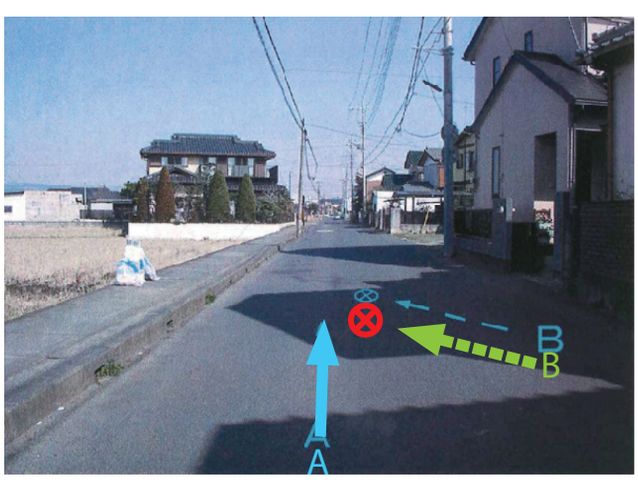
On a dark winter evening at around 6 p.m., a man in his 30s was driving to work on the night shift in a standard-sized car (A) on a straight city road without a center line. This is the road he took almost every day to work. He became inattentive while traveling at about 50 km/h because he was familiar with the road and there was little traffic around as usual, when he suddenly noticed a pedestrian (B) crossing the road from the right without using a crosswalk. Just as he noticed the pedestrian, the car hit him and threw him about 5 meters away.

The pedestrian suffered a serious head injury in this accident, which could have been prevented if the driver had kept his eyes firmly on the road ahead.

Diagram of the crash



Accident site seen from 50 meters away
The driver inattentively drove a car on a straight section of the road without a center line that he usually used to go to work, where there was almost no traffic on that day.



Accident site
The driver did not notice the pedestrian crossing the road from the right until just before the car struck him.

SECTION 6

Conclusion

This study looked at traffic accidents in terms of car speed, and found the following.

(1) Characteristics of fatal accidents caused by cars traveling in the mid-speed range (30–60 km/h)

- Approximately 60% of all traffic accident fatalities were involved in accidents caused by cars as the primary party traveling in the mid-speed range.
- In particular, pedestrians and car drivers/passengers are more likely to be killed.
- Fatal accidents caused by cars traveling in the mid-speed range are often attributed to the driver being inattentive or distracted.

(2) Characteristics of fatal accidents caused due to inattentive/distracted driving

- Tend to occur in the early morning (4-6 a.m.) and in the evening (6-8 p.m.)
- Occur more frequently on a straight section of road with no intersections that is relatively simple and requires little driving operation
- From our accident data, causes of inattentive driving include “absentmindedness” and “thinking about something else”, and causes of distracted driving include “operation or behavior unrelated to driving”, “dealing with incidents in the car” and “staring at something outside the car”.

(3) Effects of different car speeds on damage in accidents

- The faster the speed of a car, the greater the risk of death.
- In particular, pedestrians and bicyclists are more likely to be killed, especially when the traveling speeds exceed 30 km/h.
- Seat belts are highly effective for protecting car occupants and reducing the damage in an accident, especially in the high-speed range.

To prevent accidents, and to reduce damage if involved in an accident…

- Driving in the mid-speed range can often cause the driver to become careless. Always pay attention to what is happening in front of you including the actions of pedestrians and bicycles to avoid becoming inattentive or distracted even for a short time.
- Many of the causes of distracted driving can be dealt with before starting to drive, such as firmly securing your bag or other items in the car.
- Do not drive too fast.
- Always wear a seat belt to ensure safety. Make sure that everyone in the car has fastened their seat belt properly and firmly.

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