

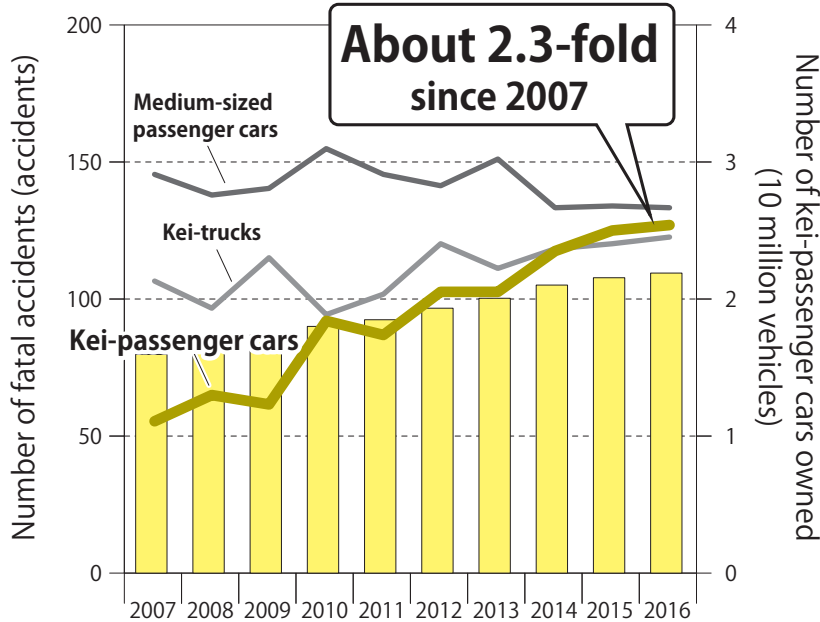
ITARDA INFORMATION

交通事故分析レポート No.126

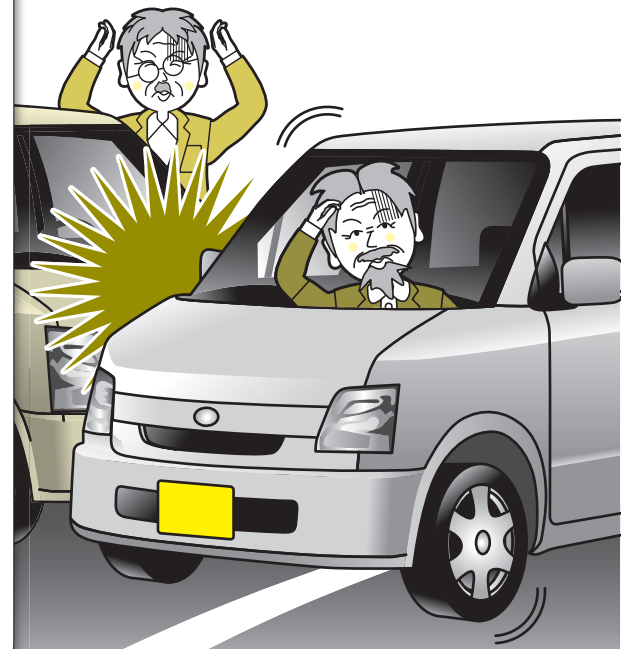
Special
feature

Fatal accidents caused by later-stage elderly people driving kei-passenger cars

~ Be careful of lane departures on main roadways! ~



Trends in the number of fatal accidents caused by later-stage elderly people (primary party) by type of four-wheel vehicle (line graph) and trends in the number of kei-passenger cars owned (bar graph)



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1 Introduction

The figure on the cover shows the trends in the number of fatal accidents in which a later-stage elderly driver age 75 or older was the primary party (the party who is most at fault of the parties involved in an accident) by type of four-wheel vehicle. This graph indicates that the number of fatal accidents caused by kei-passenger cars (small-sized passenger cars in Japan) has been rising year by year, increasing to roughly 2.3-fold the number from 2007 by 2016.

Why has the number of fatal accidents by later-stage elderly people driving kei-passenger cars increased? Presumably, this is backed by an increase in the number of later-stage elderly people who own kei-passenger cars. Fig. 1 shows trends in the number of four-wheel vehicles owned¹⁾ and Fig. 2 shows changes in the composition rate of each age group of kei-passenger car owners in 2007 and 2015.²⁾ These graphs indicate that the number of kei-passenger cars owned is increasing year by year, and that the rate of elderly owners of said vehicles has also risen. For the future, this is expected to increase at a pace that outstrips that seen so far due to the aging of the so-called baby boomer generation.

Given this backdrop, this issue of ITARDA Information will focus on later-stage elderly driving kei-passenger cars in order to discuss effective countermeasures for reducing the number of fatal accidents.

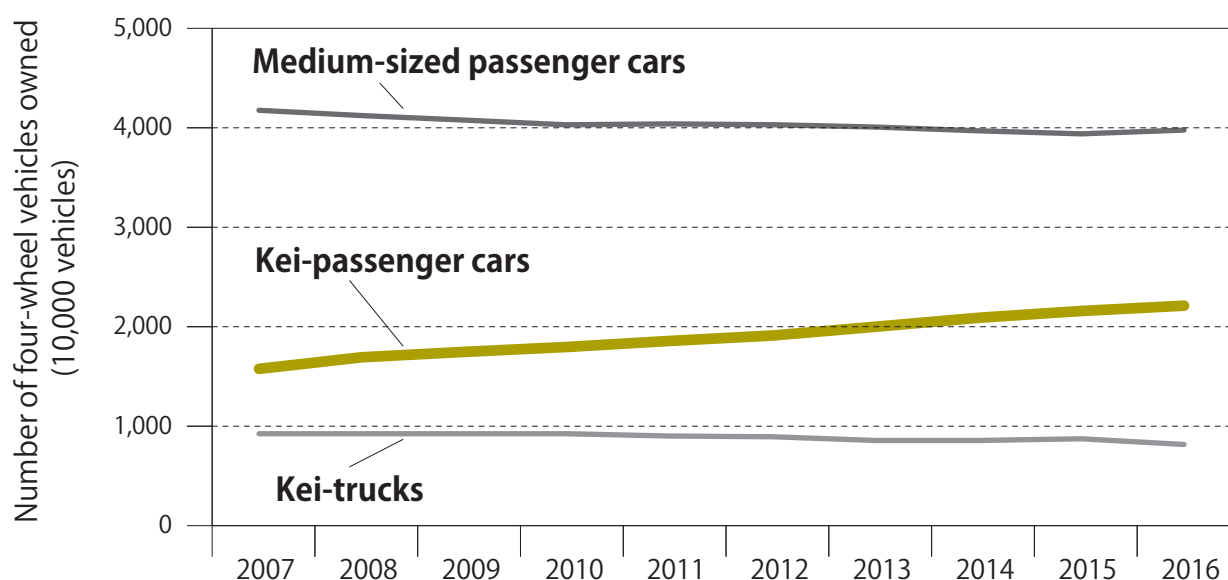


Fig. 1. Trends in the number of four-wheel vehicles owned

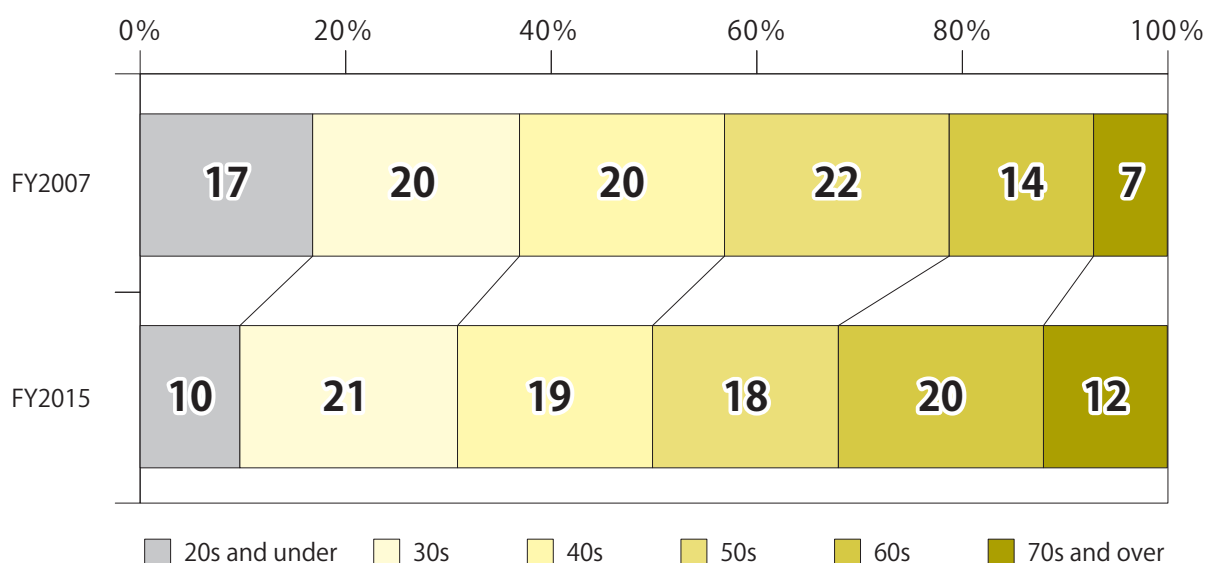


Fig. 2. Changes in the composition rate by age group of the owners of kei-passenger cars

2 Analysis of characteristic fatal accidents by later-stage elderly people driving kei-passenger cars

Fig. 3 shows the composition rate of fatal accidents by type of accident and primary party. Based on this graph, the claim can be made that later-stage elderly drivers have a higher share of head-on collisions and collisions with roadside structures compared with all ages, which holds true for both kei-passenger cars and medium-sized passenger cars. The reason for this is presumed to be because the low impact tolerance of later-stage elderly people tends to result in fatal accidents when accident do occur, with this tendency particularly pronounced with accidents involving significant damage to the driver. Although there is some degree of variance in the composition rate due to the usage conditions when comparing kei-passenger cars and medium-sized passenger cars, the later-stage elderly driving kei-passenger cars have a somewhat higher rate of head-on collisions compared with the other groups. Collisions with roadside structures account for the greatest number of fatal accidents among later-stage elderly people driving four-wheel vehicles, but this issue will perform a detailed analysis on head-on collisions.

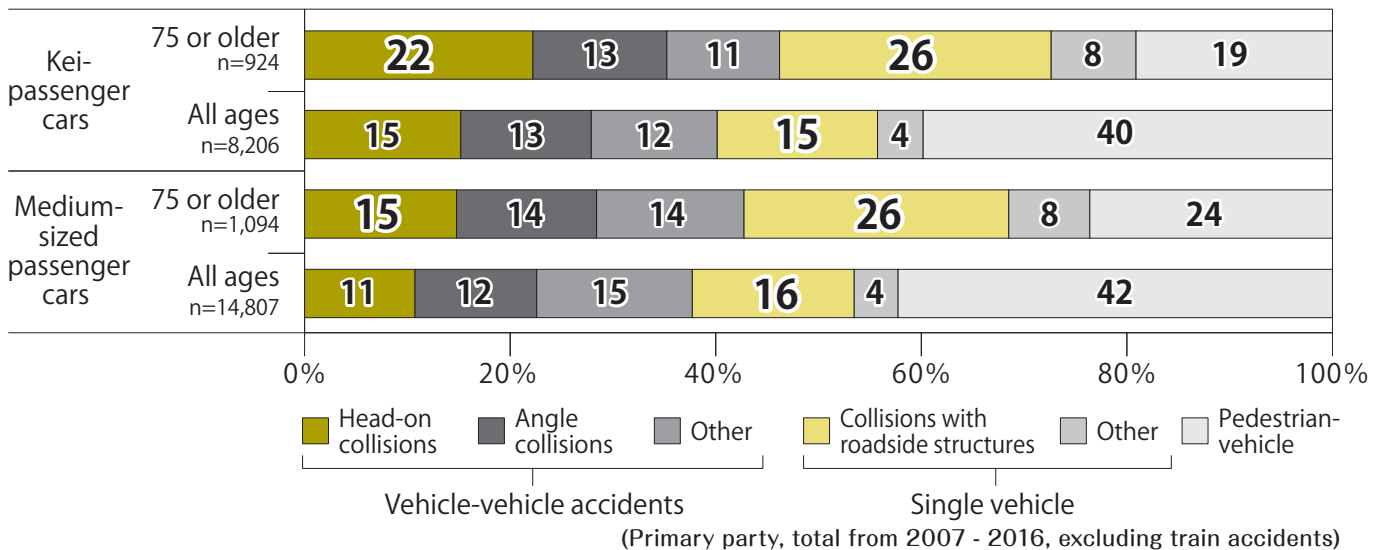


Fig. 3. Composition rate of fatal accidents by type of accident

To start with, an analysis will be performed on recent changes in the collision safety of kei-passenger cars. Fig. 4 shows the fatality rate (number of fatalities ÷ number of casualties × 100) among drivers from head-on collisions by model year of the kei-passenger car involved, which reveals that the newer the model year the lower the fatality rate. A number of improvements have been made to the collision safety of kei-passenger cars, such as enhancing their collision safety standards via regulatory revisions in 1998 and crafting the legislation for offset frontal collisions. Therefore, the claim could be made that these are having an effect. However, there is an extremely high fatality rate among later-stage elderly compared with that for all ages, which hints at the fact that it is no easy feat to protect later-stage elderly people once a head-on collision accident has occurred. While further improvements are expected when it comes to collision safety, in addition to this, enhancing “preventative safety” to prevent collisions in advance will grow more and more important in the future.

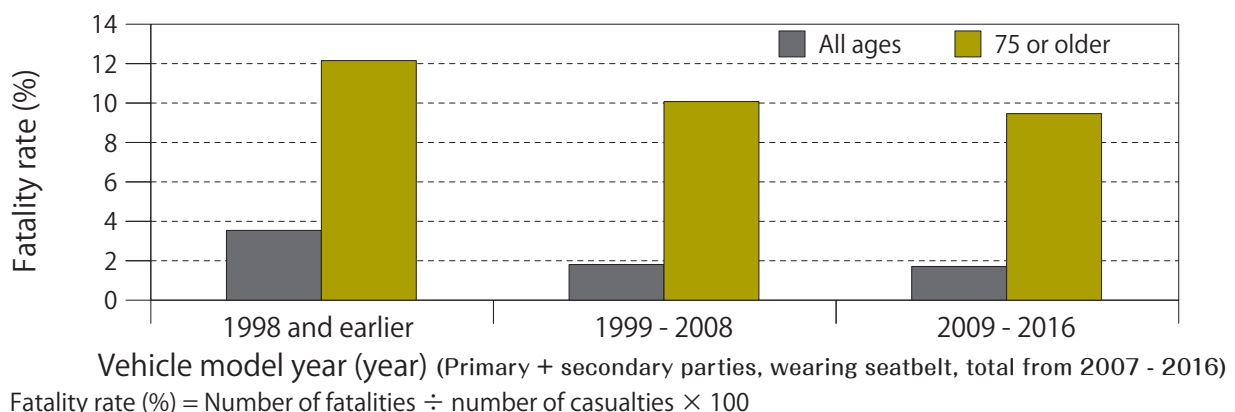


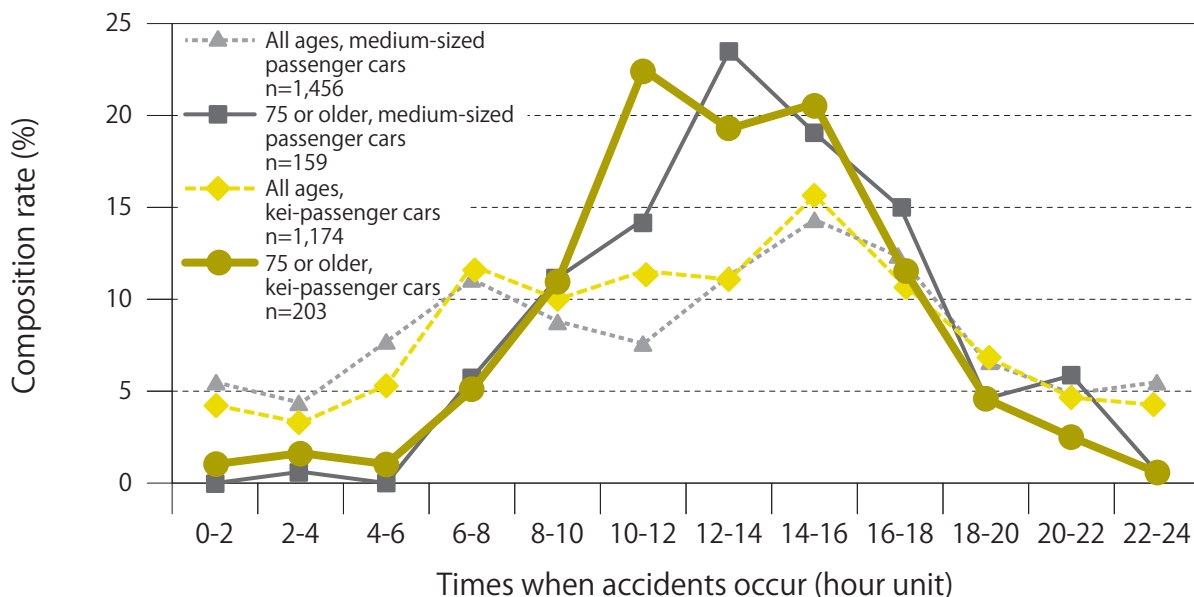
Fig. 4. Fatality rate of kei-passenger car drivers by vehicle model year (head-on collisions)

In the following section, analyses will be performed on when, where, and why later-stage elderly driving kei-passenger cars caused fatal head-on collision accidents compared with other drivers in the interest of preventative safety.

■ Time periods that fatal head-on collision accidents tend to occur

Fig. 5 shows the composition rate of fatal head-on collision accidents by time period. Fatal accidents caused by later-stage elderly people occurred more frequently in the daytime relative to all ages. It is conjectured that the reason for this is because later-stage elderly people have few opportunities to go out by car in the early morning and at night for purposes of commuting or the like.

This tendency is not just seen with head-on collisions, but across-the-board with all accidents by later-stage elderly people.



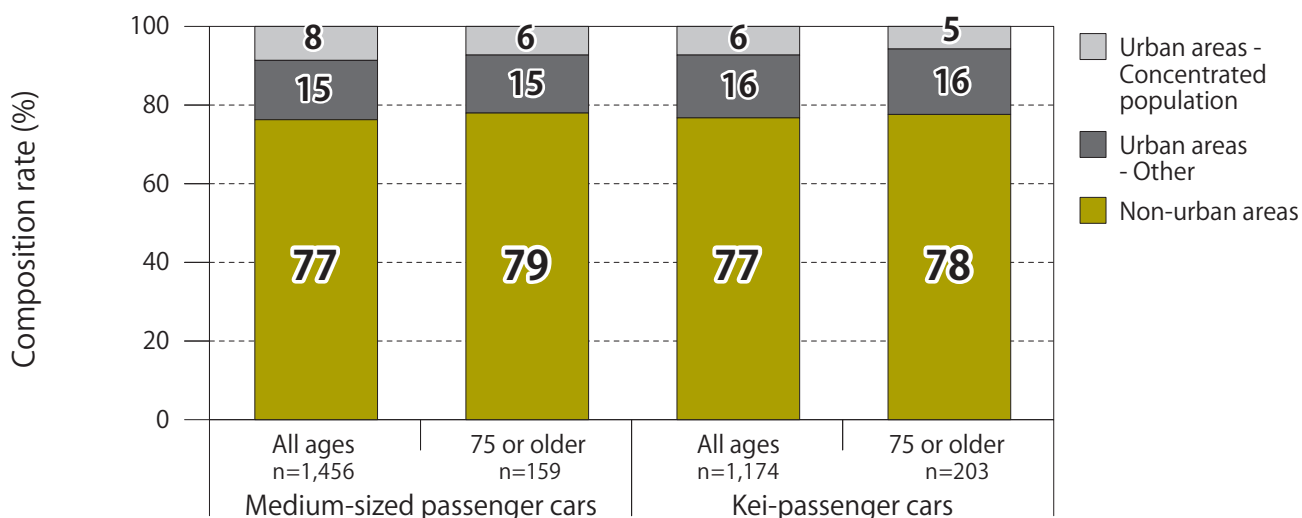
(Secondary party: Four-wheel vehicle, total from 2007 - 2016)

Fig. 5. Composition rate of fatal accidents by time period (head-on collisions)

■ Locations where fatal head-on collision accidents tend to occur

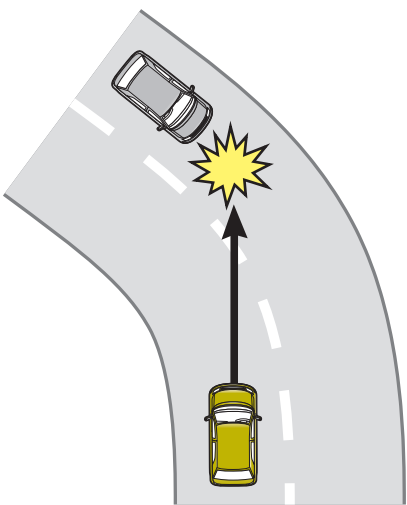
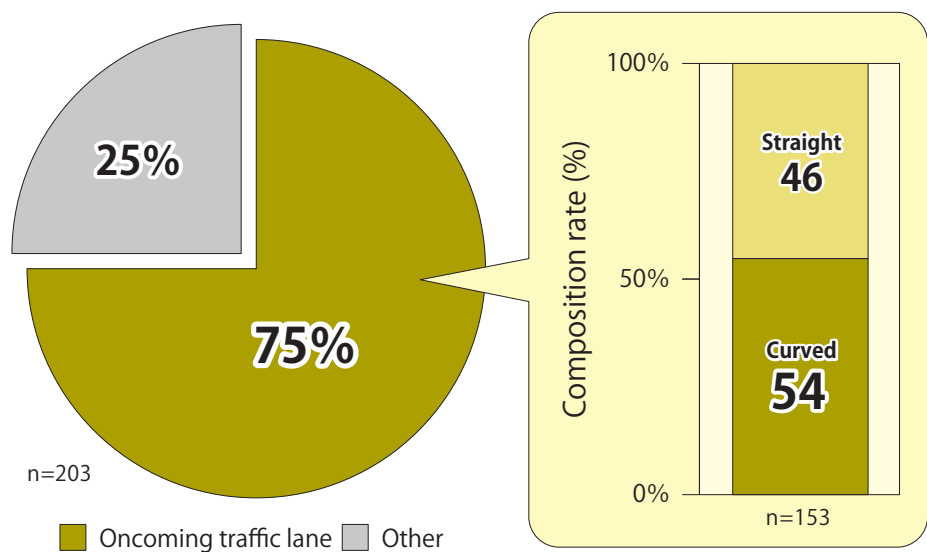
Next, the types of locations where fatal head-on collision accidents occurred will be analyzed. Fig. 6 shows the composition rate of fatal head-on collision accidents by topography. This graph reveals that approximately 80% occurred in non-urban areas where there are few homes and structures, with this holding true for all driver types. Fig. 7 shows the composition rate of fatal head-on collision accidents based on the collision site (primary party: 75 or older driving a kei-passenger car). The term “oncoming traffic lane” within the figure indicates a collision that occurred up ahead when a vehicle crossed over the center line or center divider or the like, so it can be assumed that 75% of these were accidents that occurred when the primary party departed from their lane over the center line. Moreover, Fig. 8 shows the composition rate for different road configurations of the oncoming traffic lane. It reveals that fatal head-on collision accidents are somewhat more prone to occur along curved road sections rather than straight ones.

While it is not indicated here, the same sorts of trends were observed among the other driver types.



(Secondary party: Four-wheel vehicle, total from 2007 - 2016)

Fig. 6. Composition rate of fatal accidents by topography (head-on collisions)



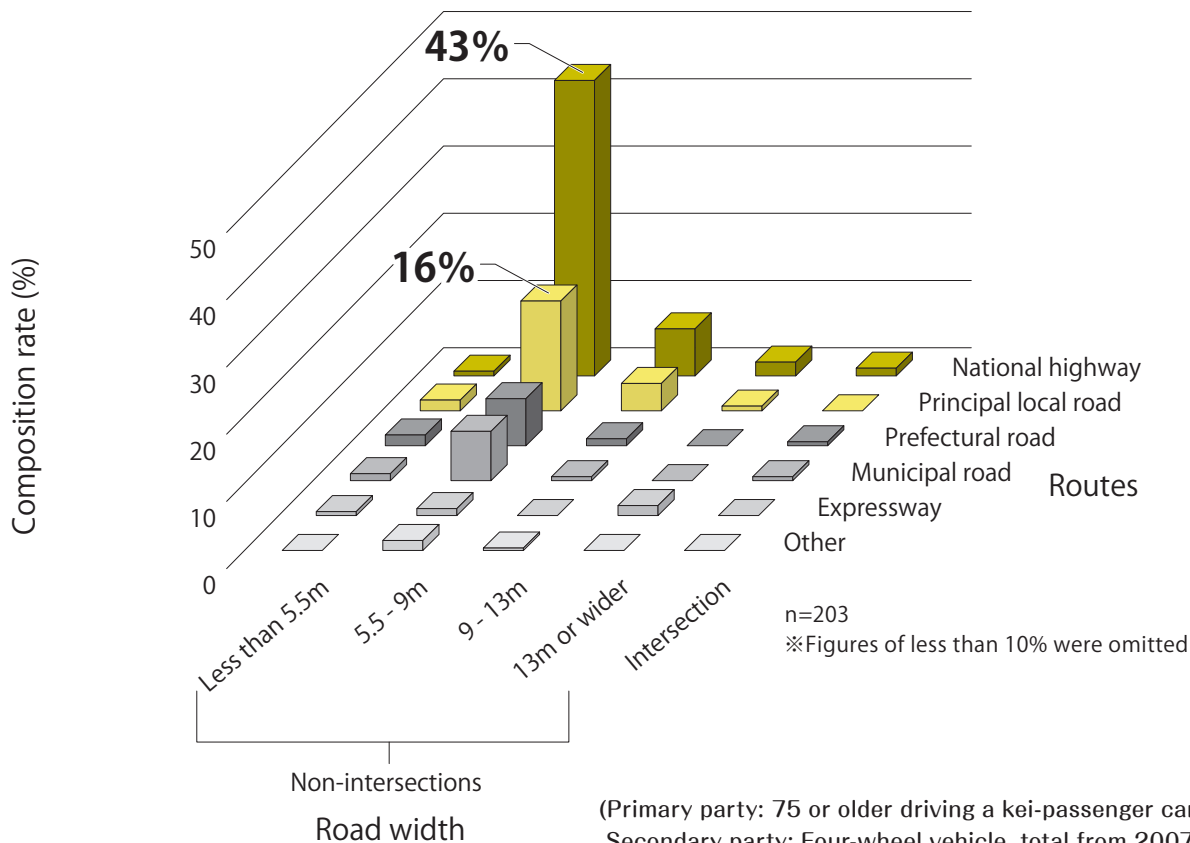
Example of a head-on collision along a curve

(Primary party: 75 or older driving a kei-passenger car,
Secondary party: Four-wheel vehicle, total from 2007 - 2016)

Fig. 7. Composition rate of fatal accidents by collision site (head-on collisions)

Fig. 8. Composition rate of fatal accidents by road configuration of oncoming traffic lane (head-on collisions)

Next, Fig. 9 shows the composition rate of fatal head-on collision accidents (primary party: 75 or older driving a kei-passenger car) by road width and route type. It indicates that such accidents are concentrated on non-intersection roads between 5.5m and 9m, as well as main roadways such as national highways and principal local roads (but excluding expressways). Moreover, based on the road width / size, it is conjectured that the majority of these accidents occurred along general roadways with a single-lane in one direction that are between 5.5m and 9m. What is not shown here, however, is that since similar tendencies are seen with other drivers this is considered to be a characteristic of head-on collision accidents in general.

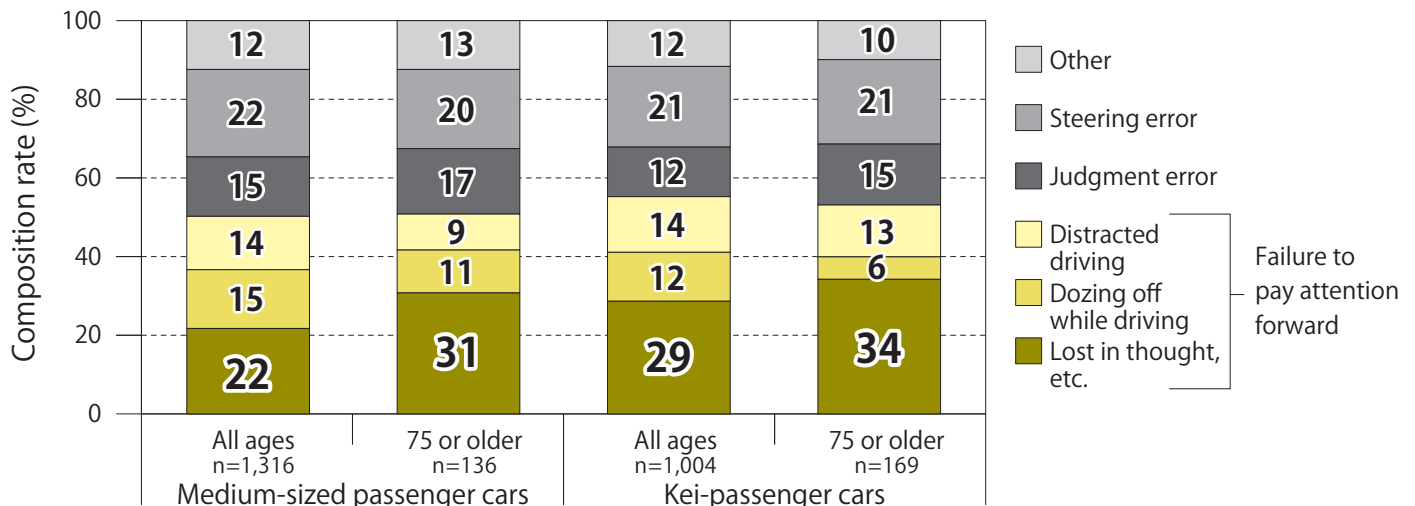


(Primary party: 75 or older driving a kei-passenger car,
Secondary party: Four-wheel vehicle, total from 2007 - 2016)

Fig. 9. Composition rate of fatal accidents by road width and route type (head-on collisions)

Human factors for fatal head-on collision accidents

Next, the question of why fatal head-on collision accidents occurred will be analyzed from the perspective of the human factors behind them. Fig. 10 shows the composition rate of fatal head-on collision accidents by human factor. According to the graph, later-stage elderly drivers tend to engage in a higher share of aimless driving, such as being lost in thought, relative to all ages, with this rate somewhat on the higher side among later-stage elderly people driving kei-passenger cars in particular compared with all ages. The reason for this is believed to be because later-stage elderly driving kei-passenger cars have frequent occasion to drive down roads they are used to traveling down for short periods of time, so while they do not reach the point of dozing off they do tend to engage in absentminded driving. In addition, failure to pay attention forward (which includes distracted driving, dozing off while driving, being lost in thought, etc.) accounts for roughly half of the accidents among all driver types, which hints at the possibility that numerous accidents could be prevented in advance if only drivers soundly paid attention to what was up ahead. Conversely, no significant differences were observed with steering error or judgment error by driver type.



(Secondary party: Four-wheel vehicle, total from 2007 - 2016, excluding cases that could not be investigated)

Fig. 10. Composition rate of fatal accidents by human factors (head-on collisions)

3 Considering examples of preventative measures for head-on collisions

Examples of infrastructure-based preventative measures for head-on collisions

Based on the analytical results thus far, the effectiveness of a number of preventative measures for head-on collision accidents will be considered. To start with, Fig. 11 shows a high visibility road marking that serves as an example of an infrastructure-based countermeasure. Since these road markings contain intermittent protrusions designed to improve visibility, they are effective at preventing drivers from deviating from their lane due to failure to pay attention forward by producing a noise or vibration when tires pass over them. On the other hand, Fig. 12 shows a center line that is called a rumble strip.³⁾ The aim with these is to effectively prevent drivers from deviating from their lane in a similar manner through the installation of indents in the road rather than protrusions. Having protrusions like those in Fig. 11 presents an obstacle for snow removal, and so these have primarily been adopted mainly in regions that experience snowfall. Soundly installing and managing these sorts of center lines will serve as an important countermeasure against accidents, particularly for major roadways with a single-lane in one direction in non-urban areas where head-on collisions frequently occur.



Fig. 11. A high visibility road marking

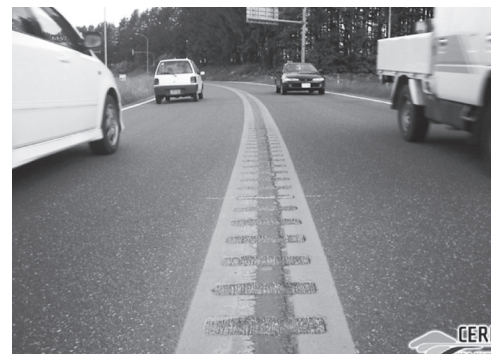


Fig. 12. A rumble strip

※Quoted from the homepage of the Civil Engineering Research Institute for Cold Region

Examples of vehicle-based preventative measures for head-on collisions

Next, vehicle-based preventative measures for head-on collision accidents will be shown. Fig. 13 shows an image of a lane-deviation warning system. These are systems that mainly use cameras mounted on the vehicle to detect lanes and issue a warning when it looks like the vehicle is about to deviate from its lane. In 2015 such systems were equipped on approximately 18% of new vehicles,⁴⁾ and they are gradually becoming more widespread. In recent years, systems that not only provide audible warnings but also cause the steering wheel to vibrate at the same time to encourage caution among drivers have begun to be practically implemented. Meanwhile, Fig. 14 is an image of a lane-deviation control system. The major difference between these and the warning systems is that these systems will intervene in the steering and braking in order to assist the driver in returning to their original lane. The expectation is that these sorts of systems will be effective at combatting accidents caused by operating errors. These systems are still only equipped on a small number of vehicle models as of now. But in recent years systems that come equipped on compact cars and kei-motor vehicles have begun to appear, and will ideally become even more widespread. Yet there are cases where both of these systems fail to function as expected on account of the conditions, so caution is required. For example, it is known that in cases like when the weather is bad or when the center line is blurry it can make it difficult for the camera to detect this. Moreover, it is envisioned that these sorts of systems will ordinarily operate when traveling at high speeds, and so at times they fail to operate during low-speed travel. Drivers must properly understand the limitations of these sorts of systems and make every effort to drive safely without being over-reliant on them.

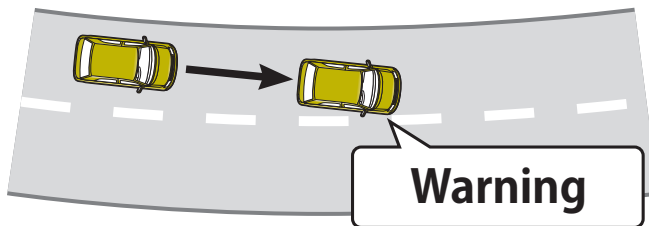


Fig. 13. Image of a lane-deviation warning system

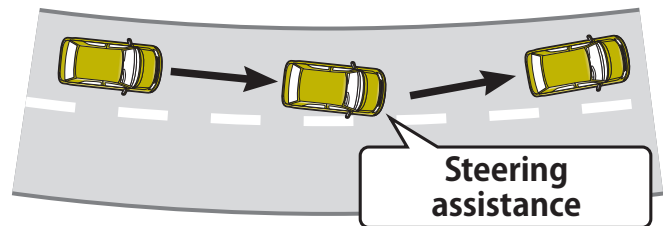
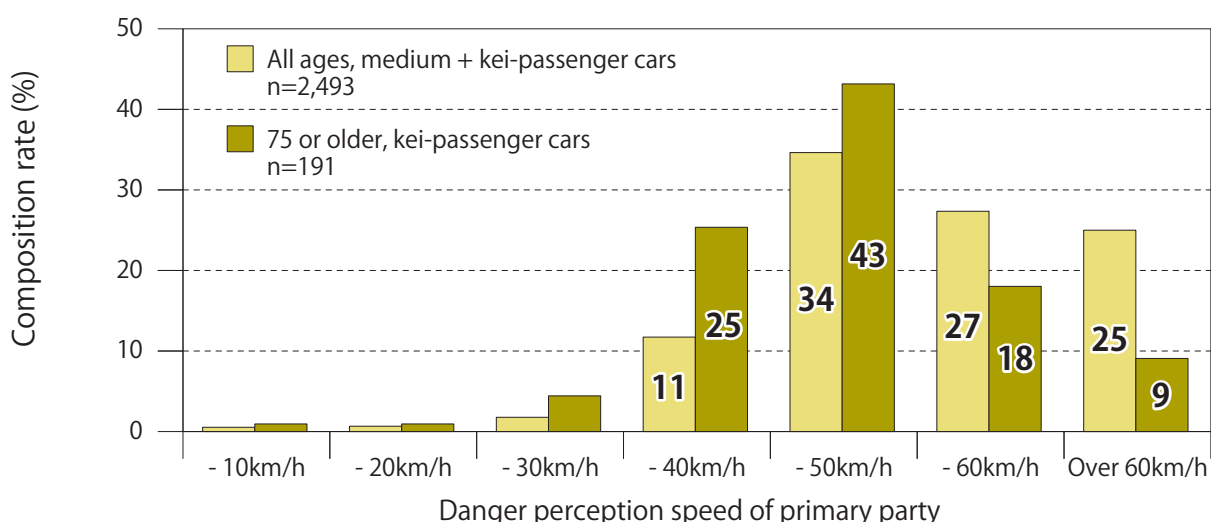


Fig. 14. Image of a lane-deviation control system

Improvements for lane-deviation prevention devices

Improvements for these lane-deviation prevention devices will be indicated based on the precautions raised above. Fig. 15 shows the composition rate of fatal accidents by the danger perception speed of the primary party. For the sake of comparison, data on kei-passenger car drivers age 75 or older and aggregate data on kei-passenger car and medium-sized passenger car drivers of all ages is shown. This graph reveals that most fatal head-on collision accidents occurred at speeds of less than 60km/h among all driver types. For later-stage elderly people driving kei-passenger cars in particular, most accidents occurred within the speed range of 30 - 50km/h, accounting for 68% of the total. For this reason, expanding the operating speed range of lane-deviation prevention systems to encompass lower speeds could potentially prevent an even greater number of fatal accidents in advance.



※Figures of less than 10% were omitted

(Secondary party: Four-wheel vehicle, total from 2007 - 2016, excluding cases that could not be investigated)

Fig. 15. Composition rate of fatal accidents by danger perception speed of the primary party (head-on collisions)

4 Conclusion

This analysis revealed that countermeasures against head-on collision accidents involving kei-passenger cars, especially preventing deviations from one's lane, are important for the sake of reducing the number of fatal accidents caused by later-stage elderly drivers. As such, expectations regarding ways to achieve this will be summarized below.

■ For road environments:

The expectation is that thorough maintenance and management will be carried out for center lines and road shoulders of major roadways, since uneven surface conditions prevent drivers from deviating from their lanes and will boost detection by vehicles with onboard cameras.

■ For preventative safety systems:

It is expected that lane-deviation prevention systems will be expanded to all vehicle models, including kei-passenger cars, and also improved upon. One point that should be improved upon for the future is to expand their operating speed range to cover slower speeds.

■ For driving awareness by elderly drivers:

Aimless driving results in the occurrence of a great many head-on collision accidents. Elderly drivers are encouraged to reaffirm the risk of head-on collisions on roads with oncoming traffic, and should make efforts to drive by focusing their attention even when driving on familiar roads during the daytime.

■ In conclusion

Kei-passenger cars play an indispensable role as an important means of transportation that offers an alternative to local public transportation for elderly people. In aiming to further reduce the number of fatal accidents among such drivers, it is not enough to just rely on improvements to the collision safety of vehicles. Rather, initiatives to popularize and advance preventative safety technology (including that for infrastructure), as well as those for integrated safety on the part of society as a whole (including post-accident care) are growing increasingly important. The expectation is that safety will be further enhanced by actually promoting such initiatives.

(Tatsuhiko Saegusa)

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