

Special  
feature

## Accidents in which children are run over at low speeds

~ Tragedies repeatedly occurring during vehicle starting ~

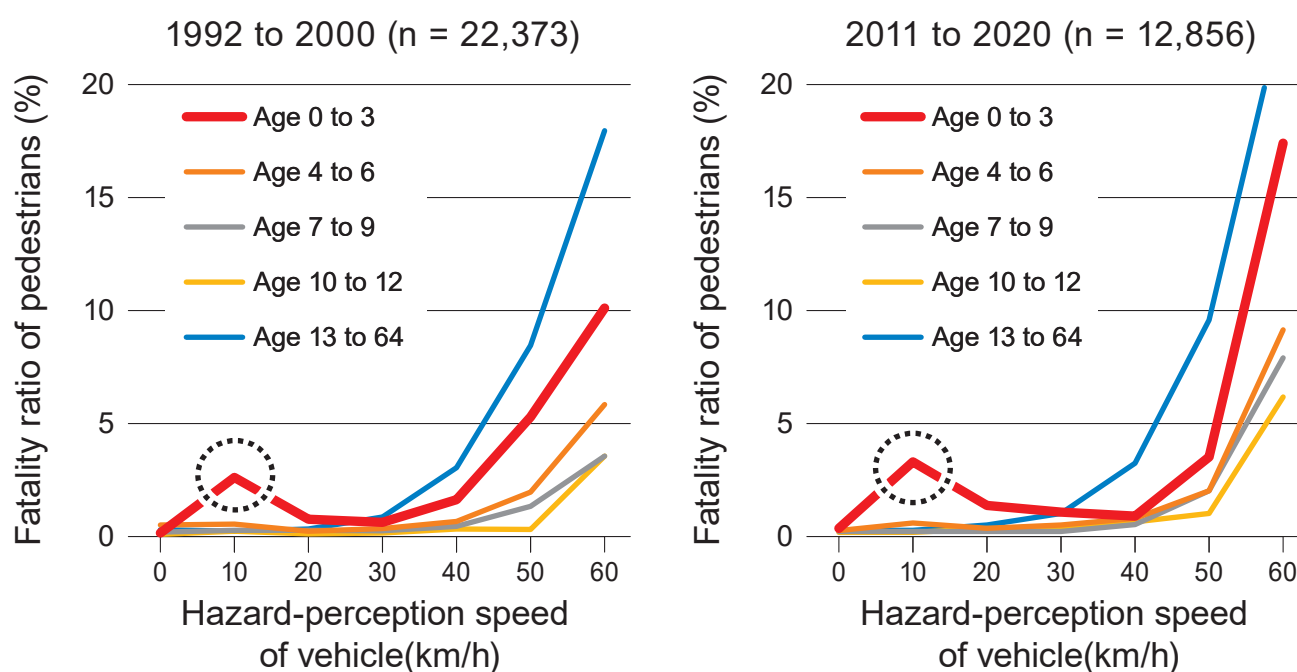


1	Characteristics of infant-pedestrian accidents .....	P1
2	Specific circumstances of accidents .....	P3
3	Characteristics of persons involved in accidents .....	P5
4	Human factors behind accidents .....	P7
5	Typical accident pattern .....	P9
6	Accident examples .....	P10
7	For reduction of accidents of this kind .....	P11

Generally, when pedestrians collide with vehicles, injuries become increasingly serious and fatality ratios become higher as vehicle speeds rise. Nevertheless, there is an age group regarding which this is not the case. Looking at Figure 1, it is clear that in the case of “age 0 to 3” alone, there is a high fatality ratio even when there is a low speed of 10 km/h or less, and moreover, that this situation has not changed much over a period of 20 years.

What could possibly be causing this type of situation?

In this issue, we will cover fatality accidents of infant pedestrians (age 3 or below) that occurred at low speeds of 10 km/h or less, and will look at the actual circumstances behind such accidents.



**Figure 1. Fatality ratio\* of pedestrians (pedestrian-to-four-wheeler accidents, total of primary and secondary parties)**

\*Calculated with “number of fatalities ÷ (number of fatalities + serious injuries + slight injuries)”

## 1

## Characteristics of infant-pedestrian accidents

First of all, we compared “age 3 or below” and “age 13 to 64” (adolescents and adults) in terms of (1) the accident location, (2) the behavior of the other party’s vehicle during the accident, and (3) the vehicle type of the other party’s vehicle.

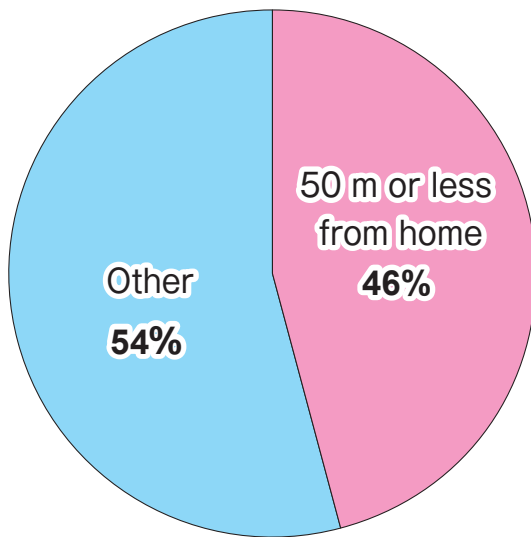
The conditions for tabulation were set as follows. (The same applies below.)

- Accident year: total of 2011 to 2020
- Accident type: pedestrian-to-four-wheeler (fatality accident)
- Hazard-perception speed of vehicle: 10 km/h or less
- Party classification: total of primary and secondary parties (regarding both pedestrians and vehicles)

## ■ Accident location

In the case of “age 3 or below,” “near the home” (50 m or less) accounted for 46%, and this was four times the level of that for “age 13 to 64.”

Pedestrians age 3 or below (n = 68)



Pedestrians age 13 to 64 (n = 177)

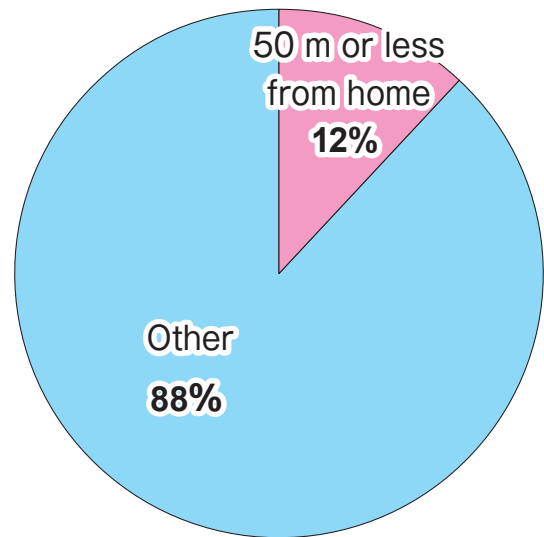
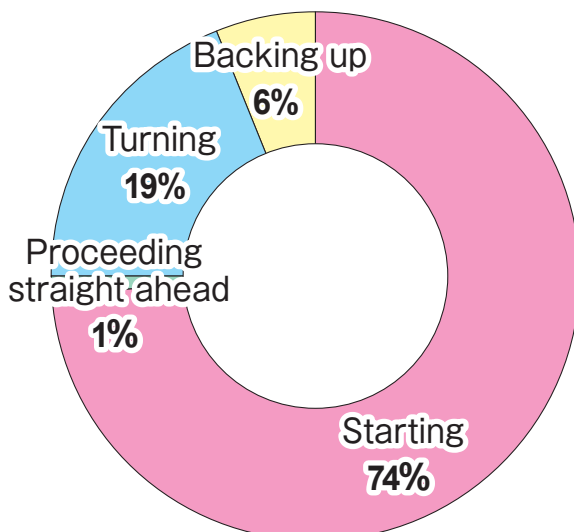


Figure 2. Distance of accident location from home

## ■ Behavior of other party's vehicle during accidents

While “starting” (74%) was overwhelmingly common for “age 3 or below,” “turning” (38%) was the most common for “age 13 to 64,” and this was followed by “backing up” (28%) and “starting” (23%).

Pedestrians age 3 or below (n = 68)



Pedestrians age 13 to 64 (n = 177)

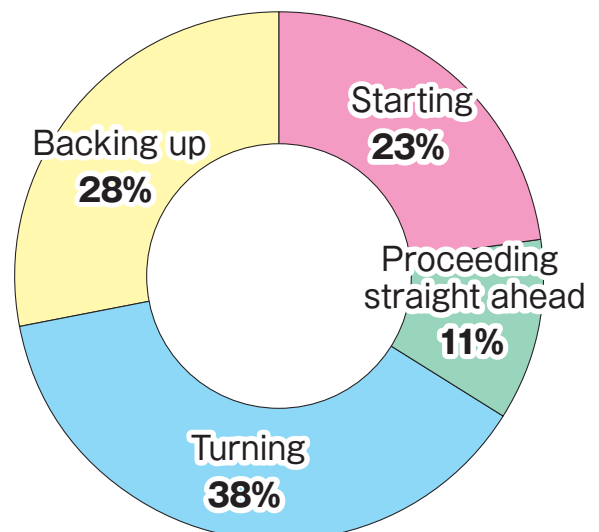


Figure 3. Type of behavior of other party's vehicle during accident

### ■ Vehicle type of other party's vehicle

Among the accidents of “age 3 or below,” passenger cars were common, especially tall ones such as minivans and one-box vans, and these two types of vehicles accounted for 52%. Meanwhile, in the case of “age 13 to 64,” cargo vehicles were the most common, accounting for 46%, and the total ratio of minivans and one-box vans stood at just 9%.

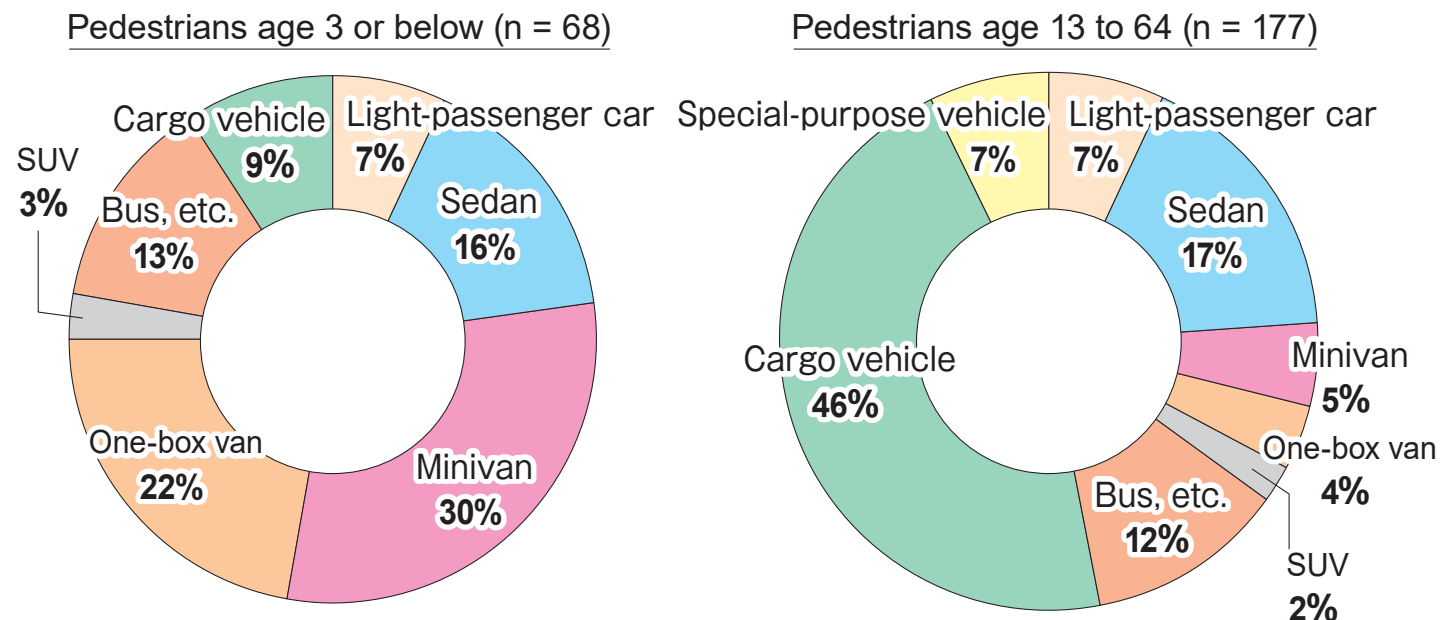


Figure 4. Vehicle type of other party's vehicle

In light of the above, it appears that the features of the accidents of “age 3 or below” are different from those of other age groups, and it seems that these features may be related to this group's characteristic “distribution of the number of fatalities.”

## 2 Specific circumstances of accidents

Specifically, under what types of circumstances are the accidents occurring? We investigated combinations of the abovementioned “accident location,” “behavior of the other party's vehicle,” and “vehicle type of the other party's vehicle” (accident scenarios), and the frequencies of occurrence.

On Table 1, it appears that in the case of accidents 50 m or less from home, many occurred during starting, and that the most common vehicle types were minivans and one-box vans. Meanwhile, in the case of accidents distant from home, many occurred at parking areas, etc., and there did not appear to be any particular deviation regarding vehicle type. Limiting the results to non-intersection locations, many of the accidents that occurred during starting involved minivans and one-box vans.

**Table 1. Accident scenario and frequency of occurrences (number of fatalities) (pedestrian: age 3 or below)**

				Vehicle type of other party's vehicle								
				Total	Light-passenger car	Sedan, etc.	Minivan	One-box van	SUV	Bus, etc.	Cargo vehicle	Special-purpose vehicle
Accident location, and behavior of other party's vehicle	50 m or less from home	Starting	Intersection	7	0	0	4	0	1	2	0	0
			Non-intersection location /railroad crossing	15	1	0	7	2	0	4	1	0
			Parking area, etc.	2	0	0	0	1	0	0	1	0
		Turning	Intersection	0	0	0	0	0	0	0	0	0
			Non-intersection location /railroad crossing	3	0	1	0	2	0	0	0	0
			Parking area, etc.	1	0	1	0	0	0	0	0	0
		Other	Intersection	0	0	0	0	0	0	0	0	0
			Non-intersection location /railroad crossing	3	1	0	1	0	0	0	1	0
			Parking area, etc.	0	0	0	0	0	0	0	0	0
	Other	Starting	Intersection	3	0	0	2	0	0	0	1	0
			Non-intersection location /railroad crossing	9	0	0	2	5	0	1	1	0
			Parking area, etc.	14	1	5	1	3	1	2	1	0
		Turning	Intersection	3	0	2	1	0	0	0	0	0
			Non-intersection location /railroad crossing	0	0	0	0	0	0	0	0	0
			Parking area, etc.	6	2	2	1	1	0	0	0	0
		Other	Intersection	1	0	0	1	0	0	0	0	0
			Non-intersection location /railroad crossing	0	0	0	0	0	0	0	0	0
			Parking area, etc.	1	0	0	0	1	0	0	0	0

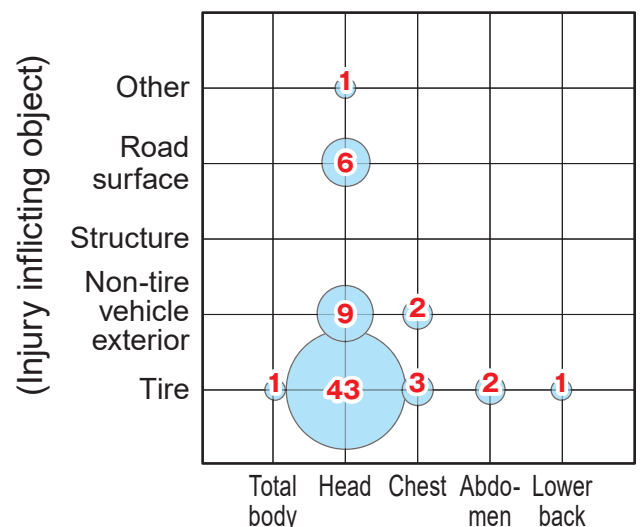
Based on the above, it appears that the fatality accidents of infant pedestrians (age 3 or below) in the low-speed category of 10 km/h or less can be divided into the following:

- ① Accidents that occurred close to home during starting
- ② Accidents at parking areas away from home
- ③ Accidents that occurred at non-intersection locations away from home during starting

Also, it seems that in the cases of ① and ③, there is a high frequency of involvement of minivans and one-box vans.

Furthermore, on Figure 5, it appears that the “main part of the body injured” (area that sustained the most serious injury) of pedestrians is centered on the head. As for the “injury inflicting object,” “tire” is the most common, and this is followed by “non-tire vehicle exterior” (bottom of vehicle body, etc.) and “road surface.” These results strongly demonstrate the traits of “accidents involving being run over” rather than those of “accidents involving being struck.”

The background of this seems to be the following. When there are accidents involving being hit by the front of a vehicle, adults will often have their lower limbs, which are below their center of gravity (waist area), undergo pushing by the bumper which causes them to fall onto the vehicle's bonnet side. Nevertheless, in the case of infants, who are low in height, the chest, etc. is pushed, and this tends to cause falling onto the road-surface side.



**Figure 5. Main part of body injured and injury inflicting object (pedestrian: age 3 or below, n = 68)**

**(Main part of body injured)**

### 3 Characteristics of persons involved in accidents

Next, we investigated the characteristics of the pedestrians and drivers (gender and age, and purpose of traveling to the accident site).

#### Gender and age

As for pedestrians, there was a large gender difference, with a male-to-female ratio of 38:62. There was an especially large number of girls age 2 or below, and they accounted for 50% of the total.

The male-to-female ratio for drivers was 49:51, and thus there were slightly more women. As for age groups, the most common for both men and women was "age 30 to 39," which was followed by "age 20 to 29," and this indicated an overlap with the parental generation of the pedestrians.

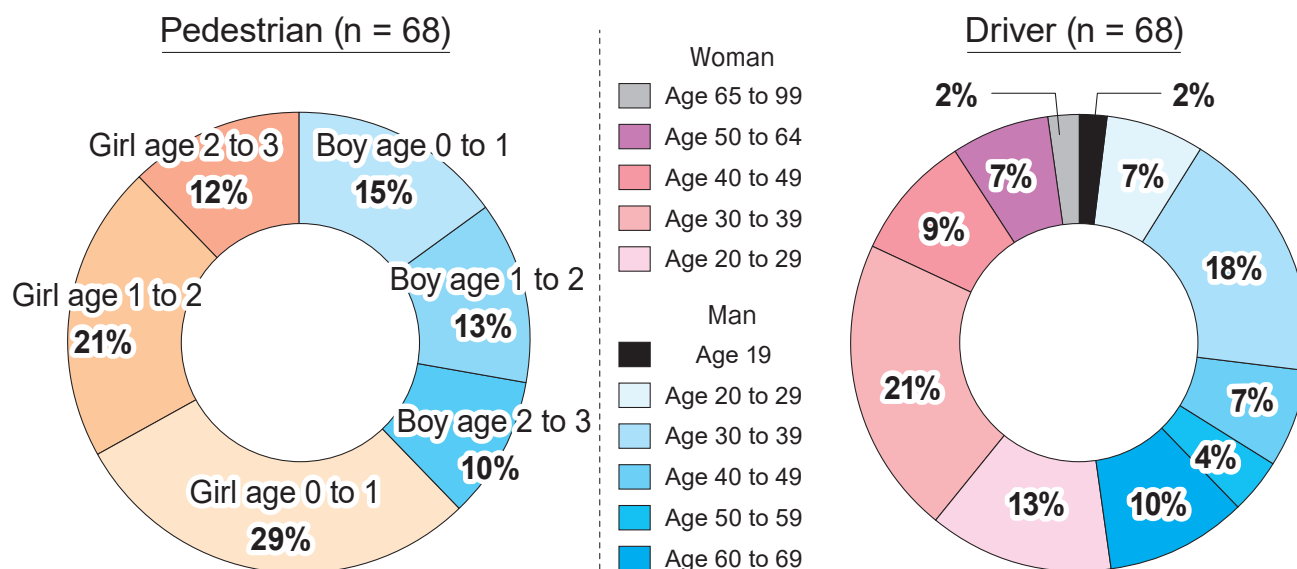


Figure 6. Gender and age of pedestrian and driver (pedestrian: age 3 or below)

#### Purpose of traveling to accident site

In the case of pedestrians, excluding "other" (details unclear), "shopping, etc." was the most common purpose (20%), and this was followed by "amusement" (18%) and "visiting someone, etc." (15%). As for drivers, the most common purpose was "visiting someone, etc." (32%), and this was followed by "shopping, etc." (25%). Thus, "shopping, etc." and "visiting someone, etc." were top-ranking purposes for both the pedestrians and drivers.

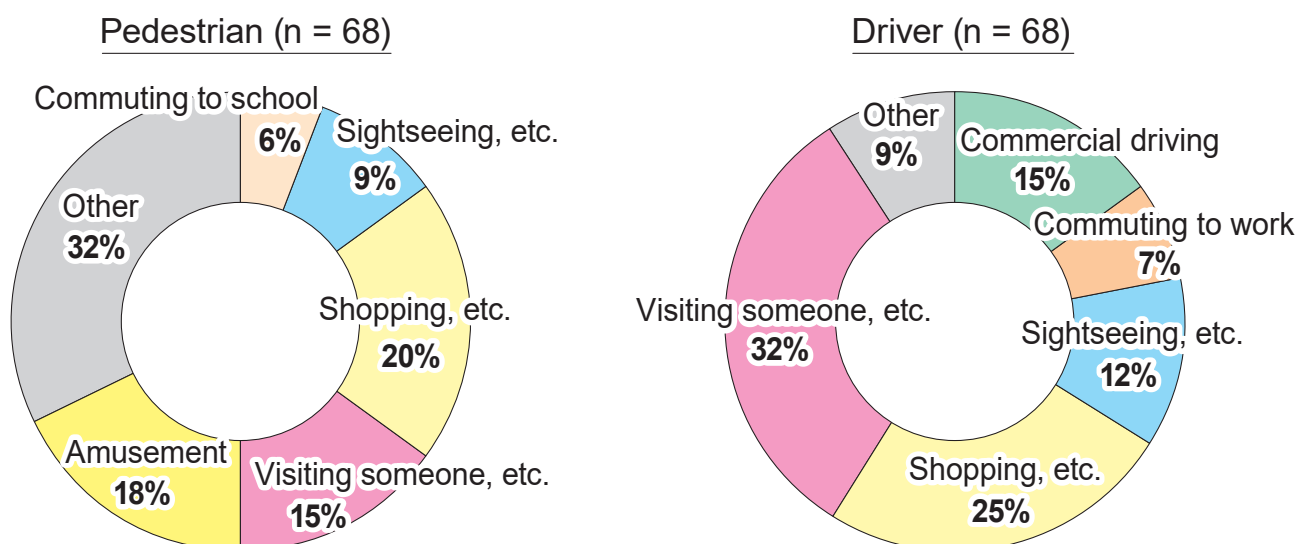


Figure 7. Purposes of travel of pedestrian and driver (pedestrian: age 3 or below)

We compiled the purposes of travel of the pedestrians and drivers into a single graph (Figure 8). In the cases that appear on top of the diagonal line, the purposes of the pedestrians and drivers are the same, and thus the two sides may be connected in some way (parent & child, acquaintances, etc.). These cases accounted for 37% of the total.

Incidentally, in similar research (Reference 1) that ITARDA carried out in FY2001, the ratio of cases in which the pedestrian and driver were connected was 33%.

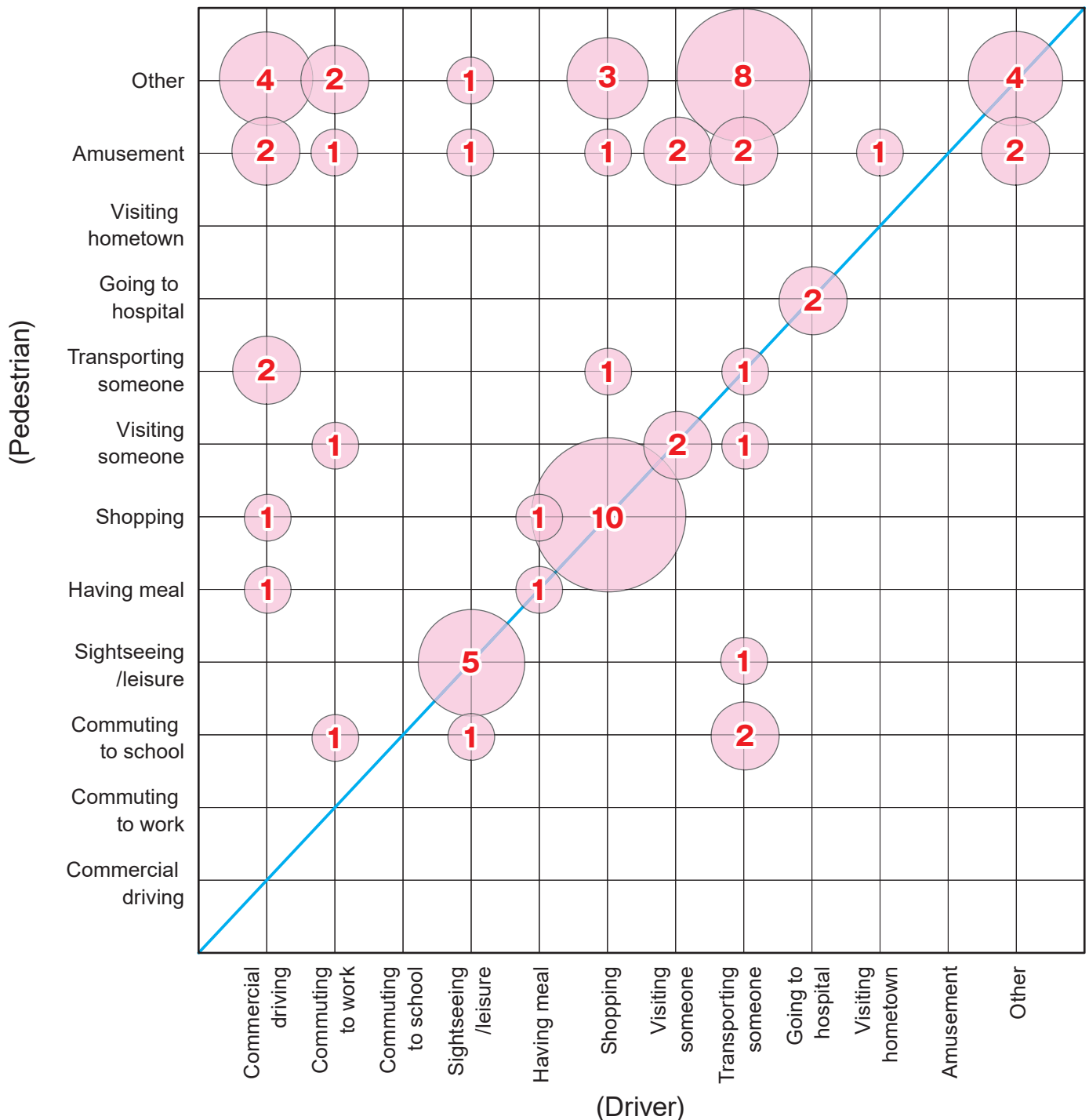


Figure 8. Purposes of travel of pedestrian and driver (pedestrian: age 3 or below)

\*The values indicate the numbers of fatalities.

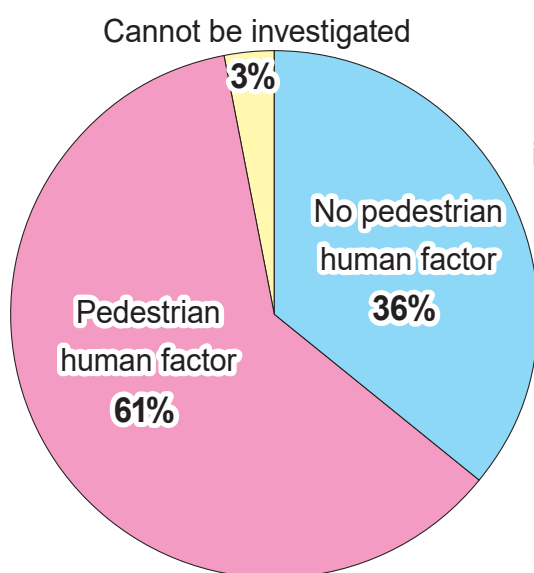


### 4 Human factors behind accidents

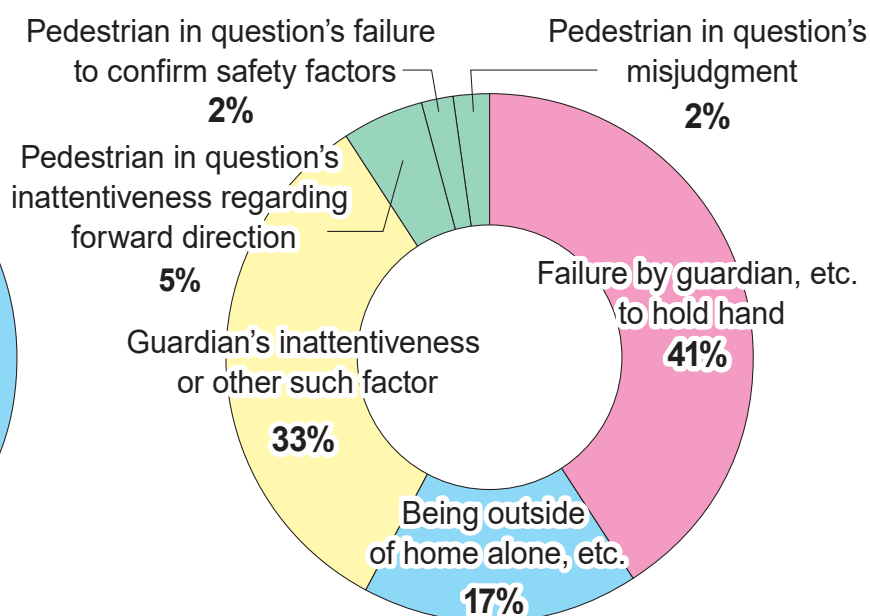
Next, we investigated the human factors behind the accidents (among the behaviors of the parties, those that had the strongest impact on the occurrence of the accident).

Figure 9 shows the human factors on the side of the pedestrians, which includes guardians. A pedestrian human factor existed in 61% of the cases, and in the breakdown of these factors, "failure by guardian, etc. to hold hand" (41%) was the most common. The most common reasons for such "failure to hold hand" were "thinking situation safe" (23%), "standing around talking" (23%), and "being distracted by shopping" (12%).

Whether there was  
pedestrian human factor (n = 68)



Breakdown of human factors (n = 39)



Reason for hand not being held (n = 17)

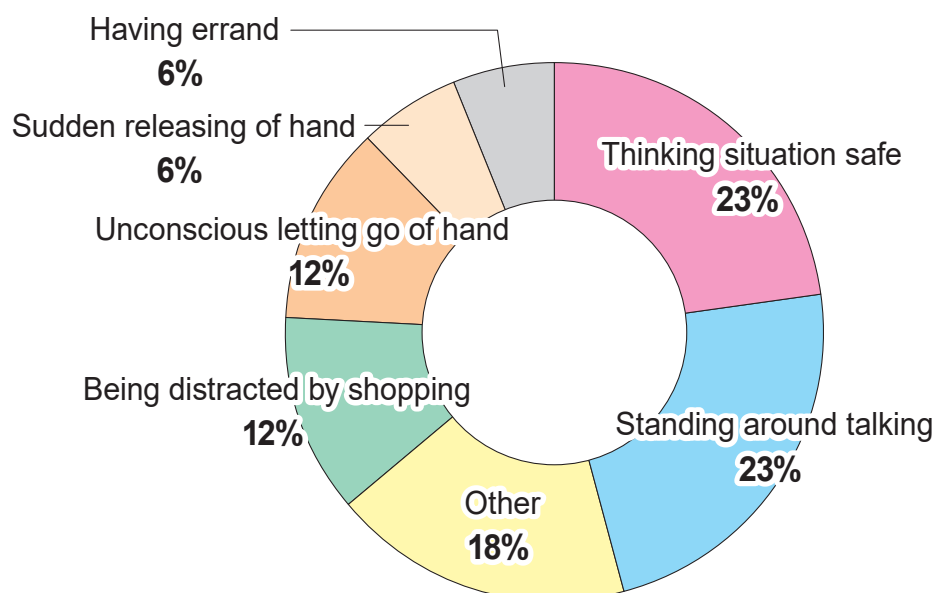
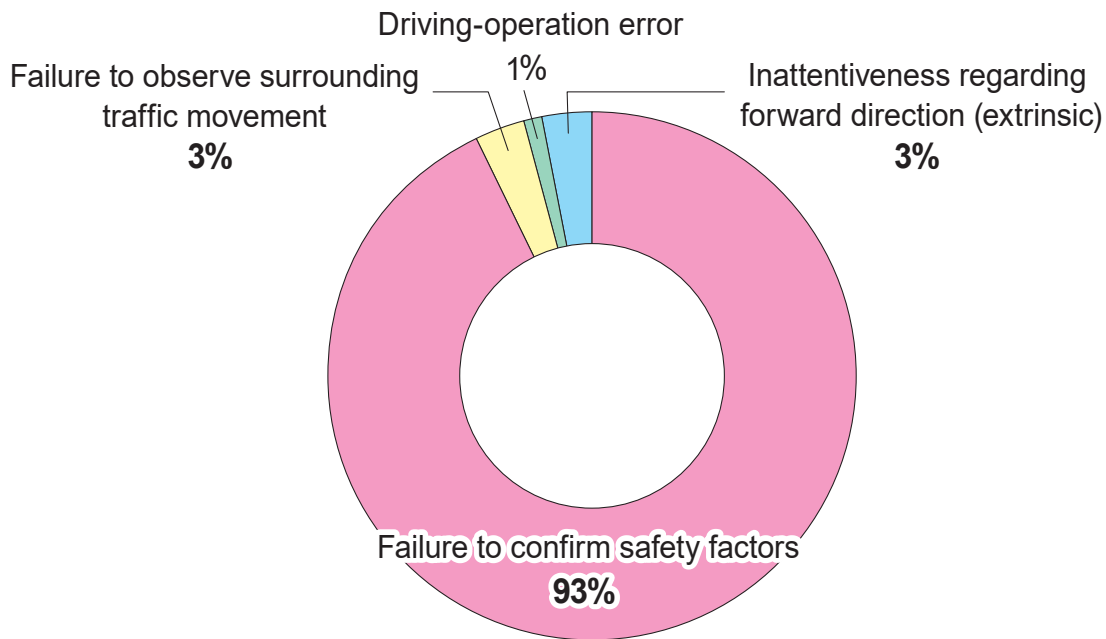


Figure 9. Whether there was pedestrian human factor, and breakdown of such factors (pedestrian: age 3 or below)



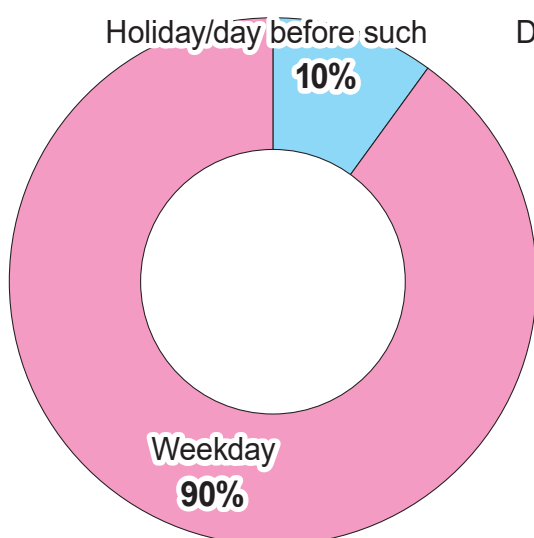
Meanwhile, on the side of the drivers, a human factor existed in all of the cases. In the breakdown of the human factors, “failure to confirm safety factors” (93%) was the most common, and this was the most common human factor regardless of vehicle type, age, and gender.



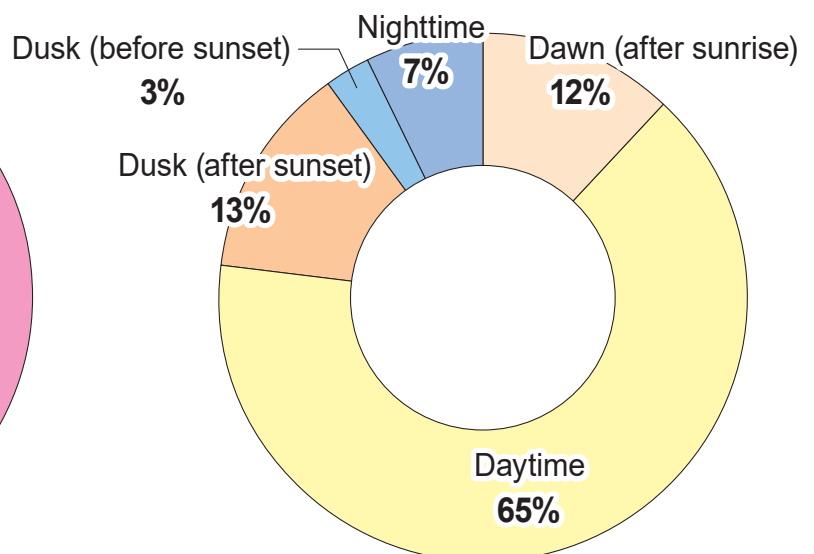
**Figure 10. Whether there was driver human factor, and breakdown of such factors (pedestrian: age 3 or below)**

Were there any types of circumstances that made confirming safety difficult? Upon investigating the day of the week, etc. and time of day of the accidents, we found that the majority of the accidents occurred on a weekday (90%) during the daytime (90%). Thus, it seems it was not the case that unfavorable conditions, such as congestion at a parking area or darkness, were having an impact on the accidents.

Classification of day of accident (n = 68)



Time of day of accident (n = 68)



**Figure 11. Classification of day, and time of day of accident (pedestrian: age 3 or below)**

## 5 Typical accident pattern

Among the accident factors that were clarified in the analysis on this occasion, we compiled the top three most frequently occurring items in Table 2.

**Table 2. Top three most frequent items among accidents factors (pedestrian: age 3 or below)**

			First place		Second place		Third place	
Day of week			Weekday	90%	Holiday/day before such	10%		
Time of day			Midday	65%	Evening	16%	Morning	12%
Accident location	Distance from home		More than 50 m	54%	50 m or less from home	46%		
	Road alignment		Non-intersection location	44%	Parking area, etc.	35%	Intersection	21%
Purpose of travel	Vehicle		Visiting/transporting someone, etc.	31%	Shopping, etc.	25%	Sightseeing, etc.	12%
	Pedestrian		Other	32%	Shopping, etc.	20%	Visiting/transporting someone, etc.	15%
Vehicle type			Minivan	30%	One-box van	22%	Sedan	16%
Type of behavior			Starting	74%	Turning	19%	Backing up	6%
Attributes	Driver	Gender	Female	51%	Male	49%		
		Age group	Age 30 to 39	38%	Age 20 to 29	21%	Age 40 to 49	16%
	Pedestrian	Gender	Female	62%	Male	38%		
		Age group	Age 0 to 1	44%	Age 1 to 2	34%	Age 2 to 3	22%
Injury situation	Main part of body injured		Head	87%	Chest	7%	Abdomen	3%
	Injury inflicting object		Tire	74%	Non-tire vehicle exterior	16%	Road surface	9%
Human factor	Driver	Exists	Yes	100%				
		Breakdown if “yes”	Failure to confirm safety factors	93%	Inattentiveness (extrinsic)	3%	Failure to observe surrounding traffic movement	3%
	Pedestrian	Exists	Yes	61%	No	36%	Cannot be investigated	3%
		Breakdown if “yes”	Failure to hold hand	41%	Other	33%	Being outside of home alone	17%

The following two types of situations can be envisioned as typical accident patterns.

- (1) The pedestrian is run over in front of his/her home during vehicle starting (minivan, etc.) by someone with whom he/she has a connection (woman).

In this case, due to the combination of a woman driver who has a relatively low height and a vehicle with a high seating position, the driver is unable to see the infant pedestrian (height of around 90 cm) standing immediately in front of the vehicle, so the pedestrian is run over at the time of starting.

- (2) At the parking area of an establishment being visited for shopping, the child suddenly runs into the path of a vehicle and is run over.

In this case, the behavior characteristics of the infant pedestrian, who has a narrow field of vision and makes sudden movements, bring about harmful results. At the parking area, where parked vehicles and the coming and going of people and vehicles make visibility poor, the pedestrian runs into the path of a vehicle with a timing that makes evasion difficult, and ends up being run over.

Next, cases that actually occurred are introduced.

## 6 Accident examples

### ■ Accident in which child was run over during vehicle starting at friend's home

Person A (age 32, woman) was visiting her friend's home, and she stopped her vehicle on a road with a narrow width, and was standing around talking with her friend. After a while, a vehicle was approaching, so in a fluster, Person A proceeded with vehicle starting order to move her vehicle onto the road shoulder. At this time, Person B (age 2, boy), the friend's child who had been standing in front of the vehicle on the left side, ended up being run over.

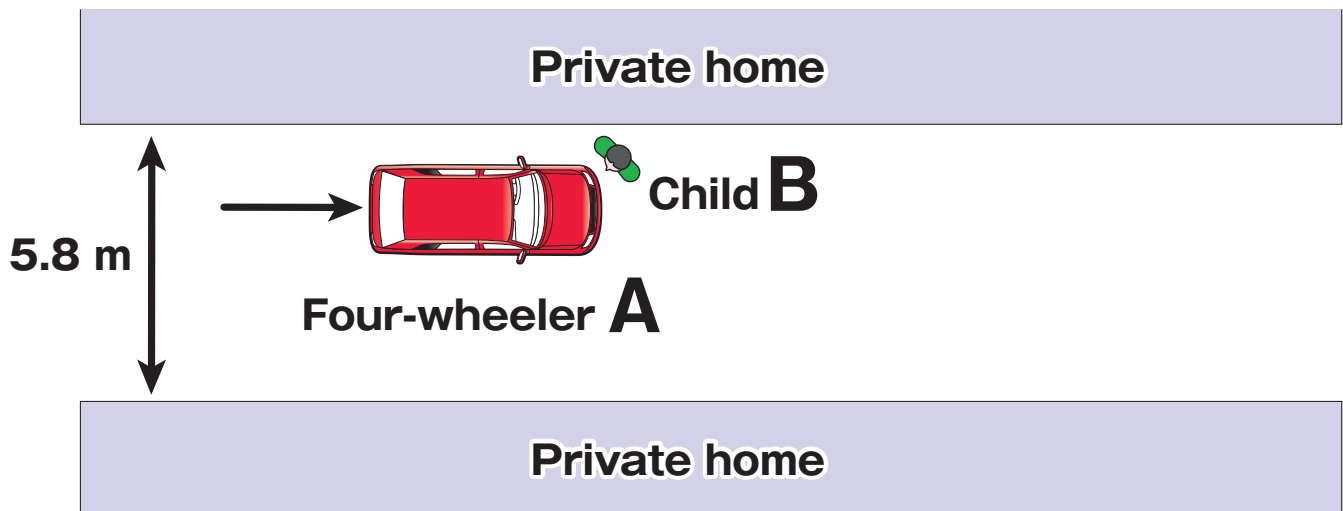


Figure 12. Accident during starting (from Reference 2)

### ■ Accident in which pedestrian ended up being run over upon running into vehicle's path at parking area of establishment

Person B (age 2, boy) was taken out his mother's vehicle, and in a state in which his hand was being held, was waiting for his mother to take out some luggage from the vehicle. Suddenly, Person B released his hand, and started walking toward the establishment's entrance. At this time, Vehicle A (SUV), a party that had just finished shopping, approached. Person B fell over upon being hit by the front-right part of Vehicle A, and then ended up being run over by the rear-right wheel.

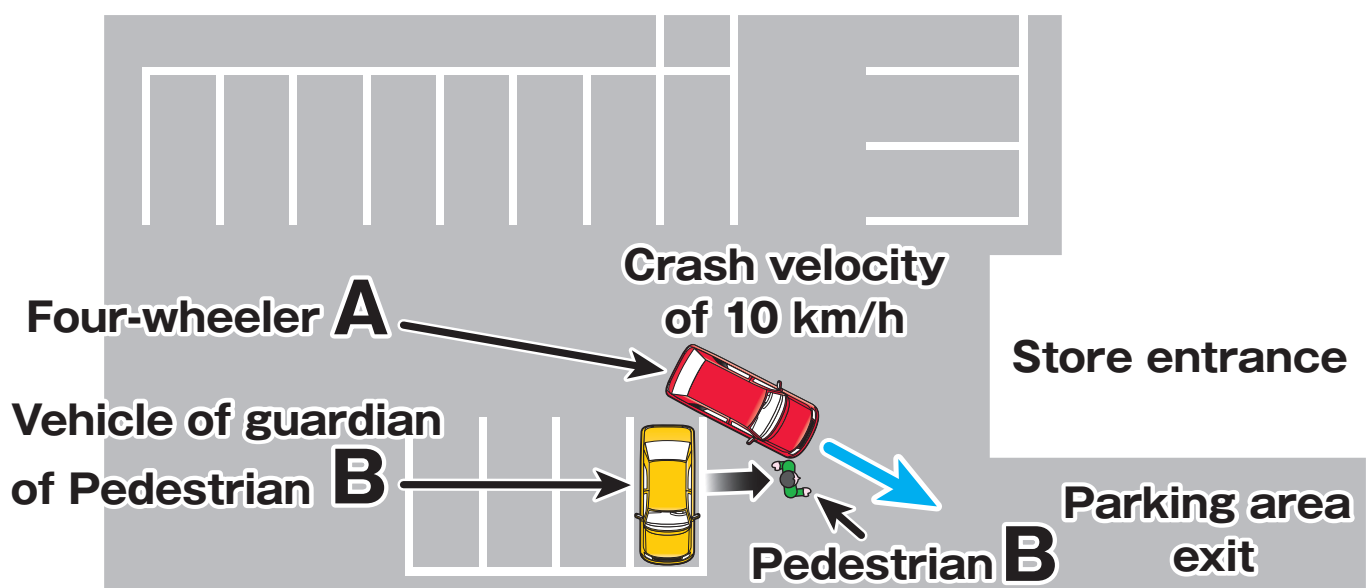


Figure 13. Accident at parking area (from Reference 3)

## 7 For reduction of accidents of this kind

It is said that safety measures are more effective the more fundamental they are, and thus in order of effectiveness these consist of: (1) isolation & energy reduction, (2) protective devices, (3) alarm devices, and (4) education (Reference 4). In the case of the accidents being looked at on this occasion in which a pedestrian is run over at a low speed, it seems that measures to reduce energy (speed) would be difficult, so measures should first of all start with the isolation of children.

Specific examples are presented below.

### ■ [Pedestrians] Developing habit of guardians holding their child's hand when in vicinity of vehicles

- It is necessary to reliably carry this out for all children, and not make any exceptions based on thinking, "This child is calm so is fine," etc. Figure 6 showed that there were many accidents involving girls, so it seems that guardians believing that their child is ordinarily calm may have contributed to their not holding the child's hand.
- There appeared to be scenarios in which guardians at the parking areas of establishment were removing luggage from their vehicle after taking their child out of the vehicle. As such, it seems that guardians should isolate their child inside the vehicle until they are ready to hold the child's hand, and not take the child out of the vehicle until they have completed their preparations.

### ■ [Drivers] Preventing approaching of children by developing habit of checking area surrounding vehicle before starting

- Safety during vehicle starting can be improved with just a little bit of extra effort. An experiment was carried out in which a doll similar in size to a two-year-old child (height 85 cm) was placed 50 cm in front of a one-box van, and then the visibility of a woman driver (height 156 cm) was checked. It was reported that although the woman was not able to see the doll from her regular driving position, she was able to see the doll if she moved her head slightly closer to the windshield by leaning forward.
- Although monitors that enable checking of the surrounding area, which are increasingly being installed in vehicles in recent years, seem to be helpful, viewing the situation directly with one's own eyes appears to be the best approach in terms of reliability. Furthermore, it seems that "boarding upon walking around the vehicle counterclockwise" (getting into the driver's seat after walking from the front of the vehicle to the left side and then to the back), which is carried out in the case of trucks that have many more blind spots than minivans, would be effective.

(Taisuke Watanabe)

#### 参考文献

- 1) (財)交通事故総合分析センター「低速域で発生する年少歩行者事故の分析」研究発表会論文, 2001年
- 2) (財)交通事故総合分析センター「イタルダ・インフォメーションNo.31」, 2001年
- 3) (財)交通事故総合分析センター「イタルダ・インフォメーションNo.115」, 2016年
- 4) ISO/TC199「ISO12100:2010 Safety of machinery  
— General principles for design — Risk assessment and risk reduction」, 2010年11月

イタルダインフォメーションに関するお問い合わせ先 渉外事業課 TEL 03-5577-3973 FAX 03-5577-3980

公益財団法人 交通事故総合分析センター

●ウェブサイト <https://www.itarda.or.jp/> ●Eメール [koho@itarda.or.jp](mailto:koho@itarda.or.jp)

本部・東京交通事故調査事務所

〒101-0064 東京都千代田区神田猿樂町2-7-8 住友水道橋ビル8階  
TEL 03-5577-3977(代表) FAX 03-5577-3980

つくば交通事故調査事務所

〒305-0831 茨城県つくば市西大橋641-1 (一財)日本自動車研究所内  
TEL 029-855-9021 FAX 029-855-9131