



Connected
Motorcycle
Consortium

CMC Basic Specification

Accident Analysis - Longitudinal Traffic

*Advanced analysis of accident types: Longitudinal traffic
based on GIDAS (German In-Depth Accident Study) data-
base.*

Document Information

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| Document Title: | Accident Analysis – Longitudinal Traffic |
| Version: | 1.0 |
| Release Date: | 1/12/2022 |

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1. Background and Objectives

To pursue the goal "improving motorcycle rider safety and comfort", CMC has studied the most frequent Powered Two Wheeler (PTW) accident scenarios in the GIDAS (German In-Depth Accident Study) database (Figure 1). Out of those accident scenarios, the longitudinal traffic scenario is found to be 18.4% of the total of PTW accidents. This is the second frequent accident scenario among all PTW accident scenarios. In addition, when the accident causer is a PTW, the longitudinal traffic scenario is actually the most frequent scenario.

CMC performed a study for longitudinal traffic accident scenarios as explained in this report, using the GIDAS database.

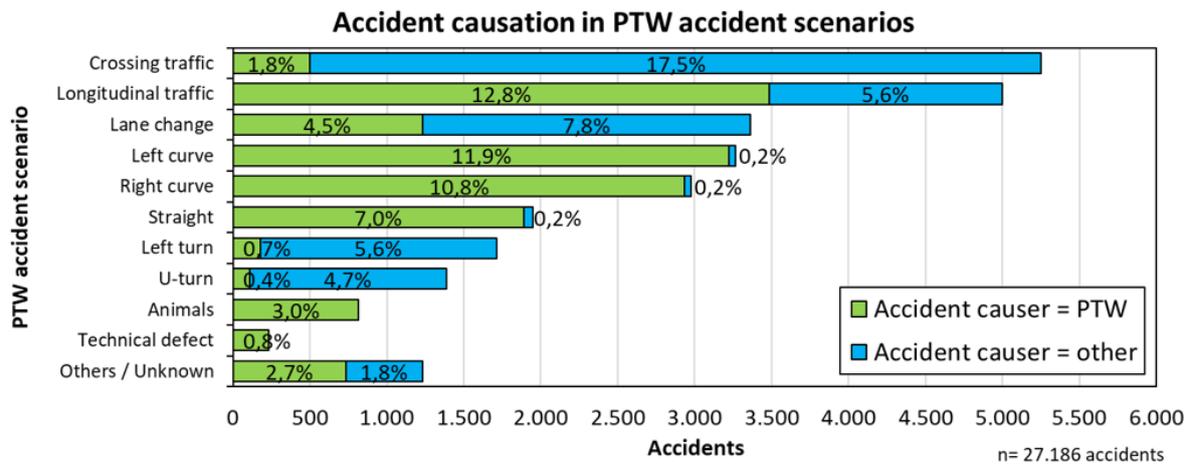


Figure 1: Accident causation in the PTW scenarios

2. Study structure

This study uses the GIDAS database which contains precise information of the actual accidents that occurred. From the database, the following fact-based data are extracted and studied.

- a) Location of the accident: rural / urban
- b) Accident scene: straight / bend / junction, etc.
- c) Kind of traffic regulation: right of way / stop sign / traffic lights, etc.
- d) Kind of road user: M1/N1, M2/N2, motorcycle, bicycle, etc.
- e) Main accident causer
- f) Main accident causation: mis-obeyed priority / turning, etc.
- g) Types of speed limitation: local limit / traffic sign, etc.
- h) Maximum permitted speed: 30 km/h, 50 km/h etc.
- i) Speed limit and distribution
- j) Speed before the accident and at the time of collision
- k) View obstruction
- l) Used lane when encountering an accident
- m) Road surface: asphalt / cobble stone / sand, etc.
- n) Precipitation at the time of the accident
- o) Road condition: dry / wet / snow, etc.

Selecting and combining the use cases for analysis

Within the longitudinal accident scenario, there exist more precise accident types as shown in Figure 2. Which use case to concentrate on has been decided from the frequency of the specific use case, i.e., accident type 601 which counts for 19.7% of all the longitudinal traffic accident types and accident type 611 which counts for 14.3% of all the longitudinal traffic accident types.

In addition, accident type 602 was combined with accident type 601 and analysed together because accident type 602 is similar to accident type 601. In a similar manner, accident type 612 was combined with accident type 611 and analysed together.

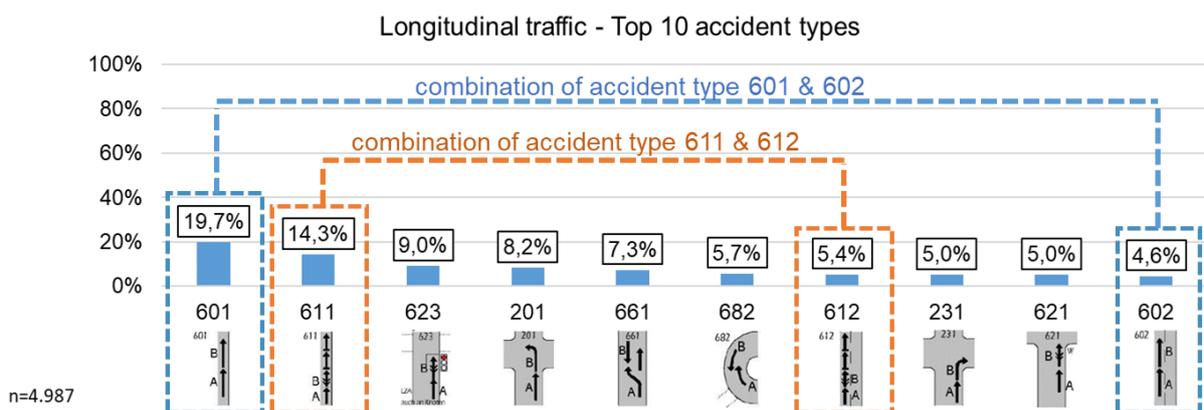


Figure 2: Selection and combination of longitudinal traffic accident type 601 & 602 and 611 & 612

3. Use case description

3.1.1 Longitudinal traffic accident types 601 & 602

The longitudinal traffic accident types 601 & 602 describe a conflict between a road user (Participant A) and a road user (Participant B) who is driving in front (Figure 3).

At the longitudinal traffic accident type 601, Participant A and Participant B are using a single lane road. On the other hand, at the longitudinal traffic accident type 602, Participant A and Participant B are using a two-lane road.



Figure 3: Longitudinal traffic accident types 601 & 602

3.1.2 Longitudinal traffic accident types 611 & 612

The longitudinal traffic accident types 611 & 612 describe a conflict between a road user (Participant A) and a road user (Participant B) who is driving in front, in a traffic congestion (Figure 4).

At the longitudinal traffic accident type 611, Participant A and Participant B are using a single lane road. At the longitudinal traffic accident type 612, Participant A and Participant B are using a two-lane road.

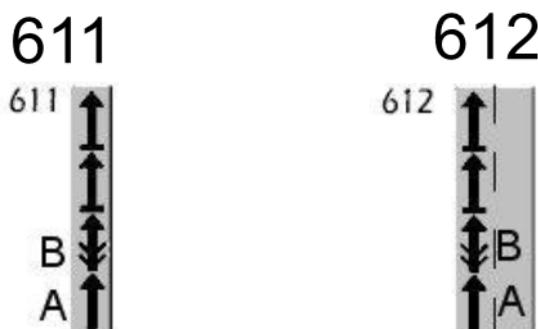


Figure 4: Longitudinal traffic accident types 611 & 612

4. Summary of the Analysis Results

In this chapter, a summary of the analysis results is provided. Detailed analysis results can be found in Chapter 5.

4.1 Longitudinal traffic accident types 601 & 602 and 611 & 612

Main findings.

- The location of the accident and the accident scene of accident types 601 & 602 and 611 & 612 show a similar distribution, i.e. about 60% of PTW accidents occurred on urban roads, next about 30% occurred on rural roads (5.1.1), about 70% happened at straights (5.1.2).
- In many cases, Participant A is a PTW and Participant B are M1 / N1 vehicles (passenger cars / light commercial vehicles) followed by PTWs (5.1.4).
- The main accident causer of accident types 601 & 602 is Participant A, in 91.5% of all these accidents. More specifically, Participants A which are PTW riders count for 71.5% of all these accidents. In the same way, the main accident causer of accident types 611 & 612 is Participant A (at 98.8%) and more specifically, Participants A being PTW riders (at 75.8%) (5.1.5).
- The initial speed of Participant A in accident types 601 & 602 and 611 & 612 is similar, with a median of 50 km/h. The initial speed of Participant B in accident types 601 & 602 is 40 km/h and in accident types 611 & 612 it is 30 km/h (5.1.10).
- If the main accident causer is a PTW, at the accident types 601 & 602, compared to the initial speeds without differentiation of the main accident causer, the initial speeds of both participants are slightly higher (Participant A: 54 km/h, Participant B: 45 km/h). At the accident types 611 & 612, the initial speed of Participant A is the same and that of Participant B is 7 km/h higher (37 km/h) (5.1.10).
- In accident types 601 & 602, Participants A have a higher median collision speed than the Participants B (Participant A: 38 km/h, Participant B: 10 km/h). Similarly, in the accident types 611 & 612, Participants A have a higher collision speed than Participants B (Participant A: 35 km/h, Participant B: 0 km/h) (5.1.10).
- Comparing the collision speeds if the main accident causer is a PTW, versus all accident types 601 & 602 and 611 & 612 without differentiation of the causer, the collision speeds are the same or within 1 km/h difference (5.1.10).
- In 90% or above of accident types 601 & 602 and 611 & 612, no view obstruction was present. The remaining rare cases involved permanent view obstruction such as buildings, and non-permanent obstruction such as moving and parked cars (5.1.11).
- In 80% or above of accident types 601 & 602 and 611 & 612, accidents happened on conventional asphalt (5.1.13). In addition, in 90% or above accidents happened without precipitation (5.1.14).

5. Longitudinal traffic accident analysis

In this chapter, the details of the longitudinal traffic accident analysis results about accident types 601 & 602 and 611 & 612 are shown.

5.1 Analysis results

5.1.1 a) Location of the accident

At the longitudinal traffic accident types 601 & 602, the majority (61.8%) of PTW accidents occurred on urban roads. Next, nearly every third accident happened on rural roads without motorways. Then, approximately 8% of the accidents occurred on motorways (Figure 5).

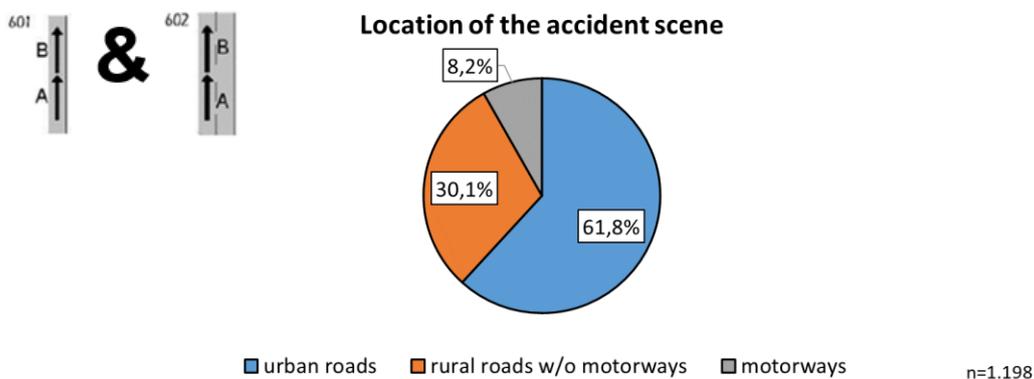


Figure 5: Location of the accident (601 & 602)

At the longitudinal traffic accident types 611 & 612, the majority (59.9%) of PTW accidents occurred on urban roads. Next, more than one in four accidents occurred on rural roads without motorways. Then, approximately 12% of the accidents occurred on motorways (Figure 6).

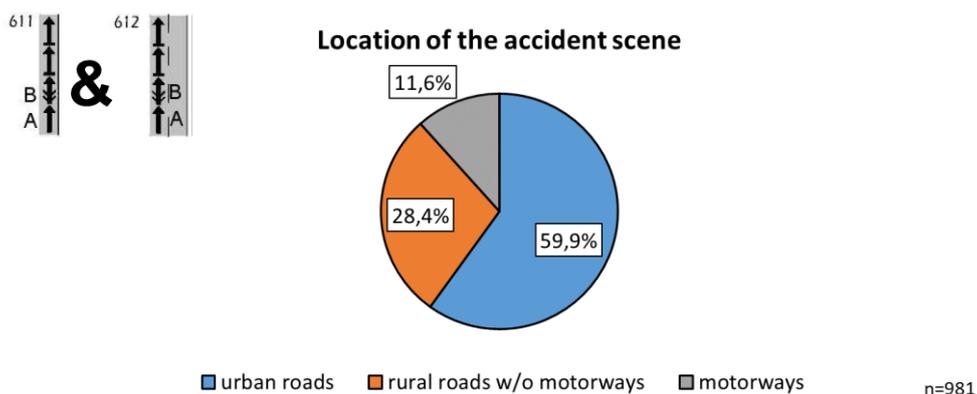


Figure 6: Location of the accident (611 & 612)

There is no big difference regarding the location of the accident between the longitudinal traffic accident types 601 & 602 and 611 & 612.

Motorways do not account for a high share of the accident scene; however it may be said that motorways are a remarkable location for longitudinal traffic accidents, since crossing and left turn accidents and so on basically do not occur on motorways.

5.1.2 b) Accident scene

At the accident types 601 & 602, the majority (70.0%) of the PTW accidents happened at straights. Then, 11.5% of these accident types occurred at junctions, and approximately 9% occurred at crossings (Figure 7).

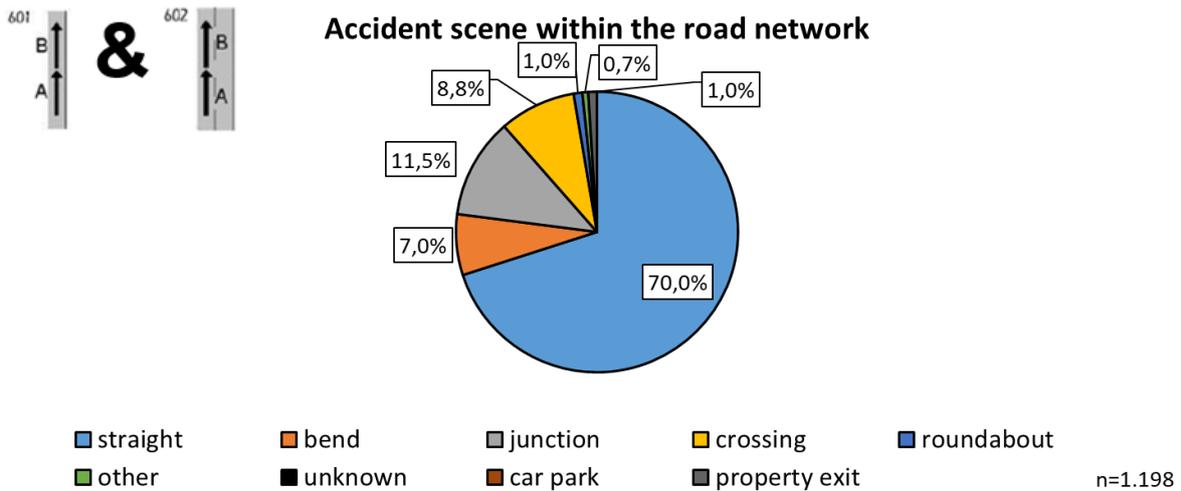


Figure 7: Accident scene (601 & 602)

At the accident types 611 & 612, the majority (71.9%) of the PTW accidents happened at straights. Then, 10.1% of these accident types occurred at junctions, and approximately 9% occurred at bends (Figure 8).

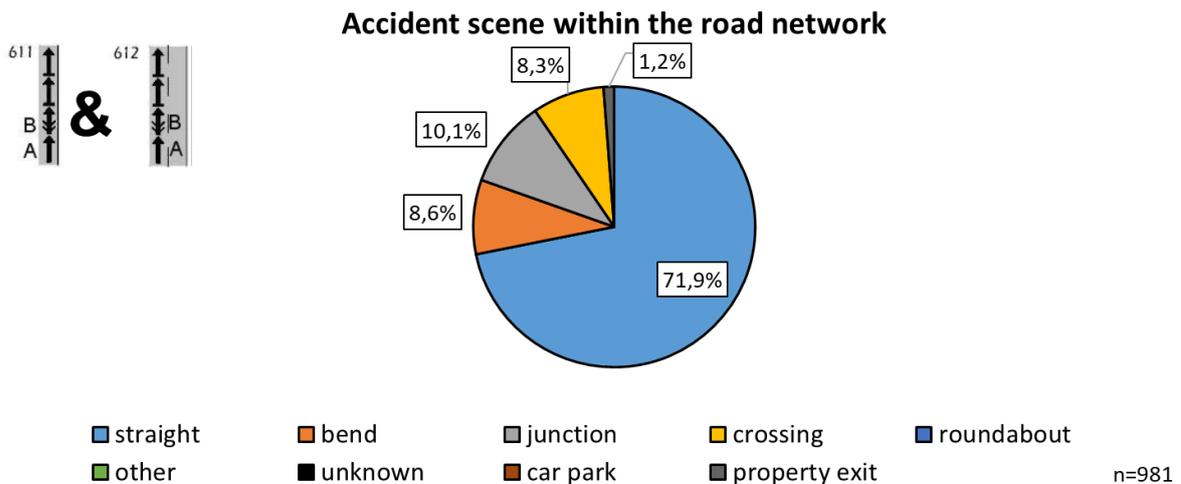


Figure 8: Accident scene (611 & 612)

Although the proportion of bends at the accident types 611 & 612 is slightly higher compared with the accident types 601 & 602, overall there are no big differences regarding the accident

scene within the road network between the longitudinal traffic accident types 601 & 602 and 611 & 612.

5.1.3 c) Kind of traffic regulation

At the accident types 601 & 602, the majority (72%) of the PTW accidents are not regulated, namely the two participants in the accident were on a road where none of the traffic regulations. Then, 13.8% of these accident locations are regulated by traffic lights and 11.2% of these accident types are regulated by the right-of-way-rule and 3% by other regulations (Figure 9).

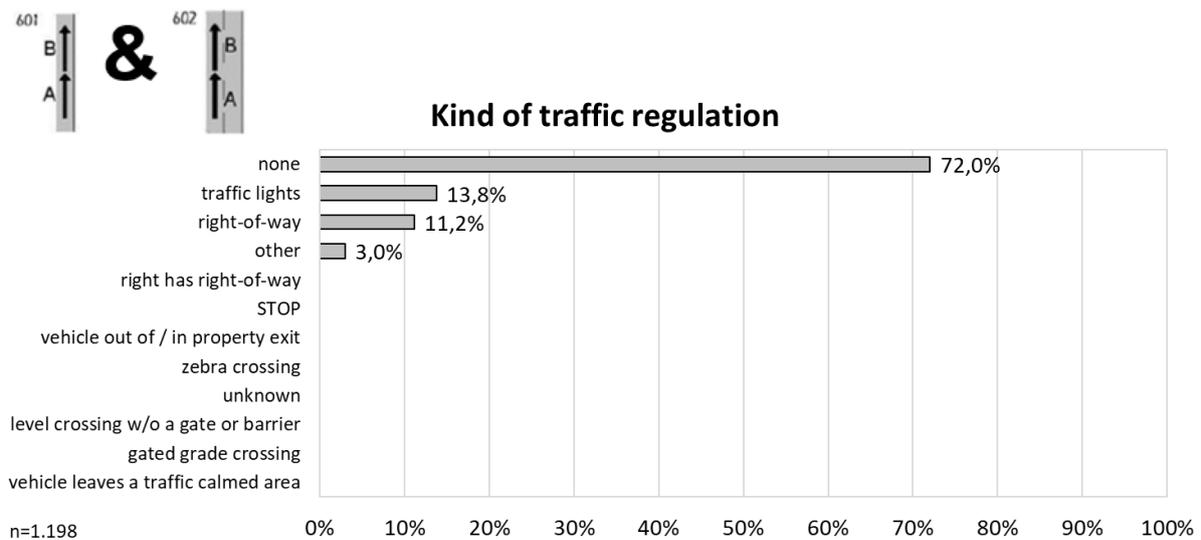


Figure 9: Kind of traffic regulation (601 & 602)

At the accident types 611 & 612, the majority (76.8%) of PTW accidents are not regulated. Then, 10.7% of these accident locations are regulated by traffic lights and 6.7% of these accident types are regulated by the right-of-way-rule (Figure 10).

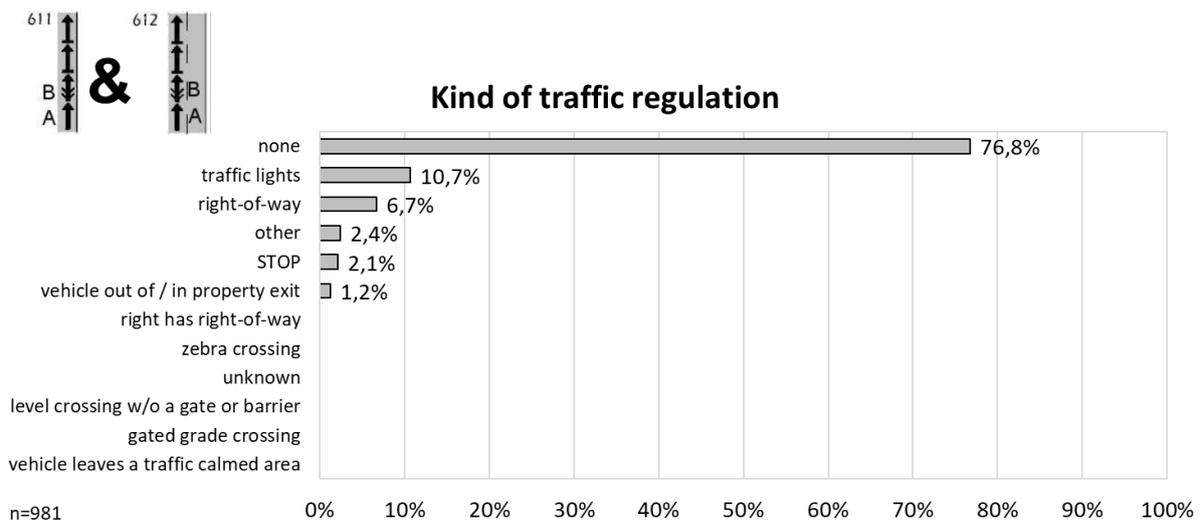


Figure 10: Kind of traffic regulation (611 & 612)

5.1.4 d) Kind of road user

At the accident types 601 & 602, the majority (79%) of Participants A are PTW riders. Then, 20% of Participants A are M1/N1 vehicles (passenger cars/ light commercial trucks). Participants B are mostly M1/N1 vehicles (65.7%) followed by PTW riders (28.8%) (Figure 11).

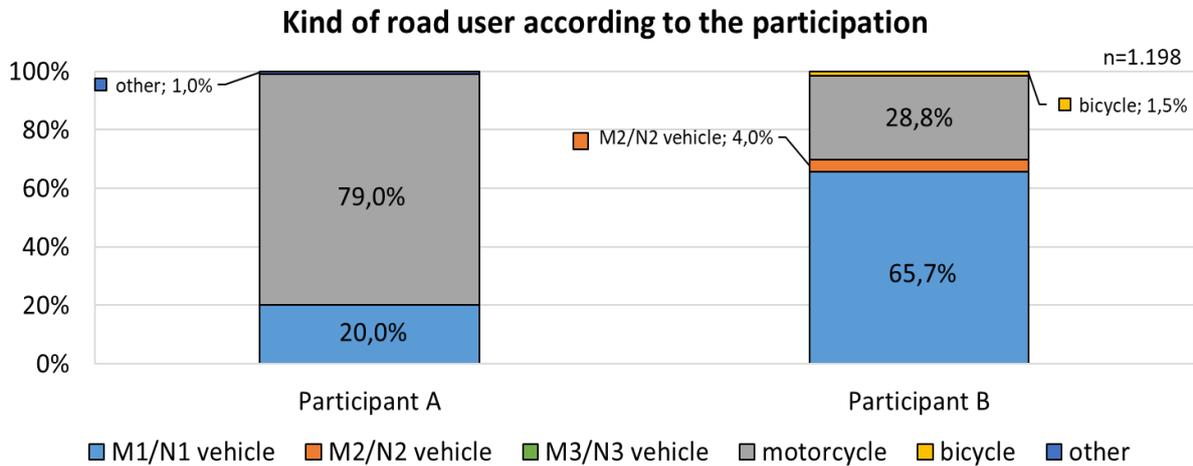


Figure 11: Kind of road user (601 & 602)

At the accident types 611 & 612, the majority (75.8%) of Participants A are PTW riders. Then, 22% of Participants A are M1/N1 vehicles. Participants B are M1/N1 vehicles (78.6%) and PTW riders (17.7%) (Figure 12).

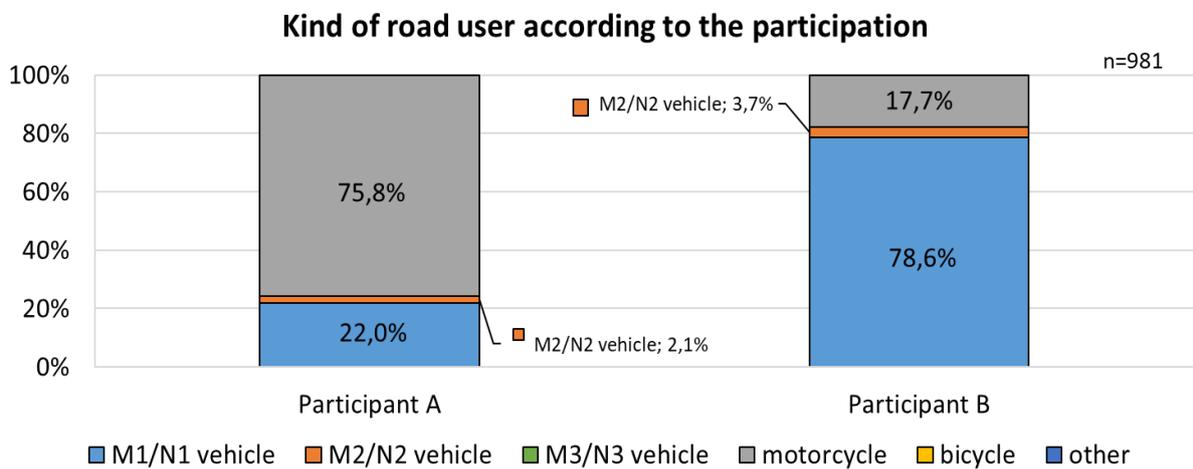


Figure 12: Kind of road user (611 & 612)

5.1.5 e) Main accident causer

At the accident types 601 & 602, the majority (91.5%) of PTW accidents are caused by Participant A. More specifically, the most frequent main accident causers are Participants A being PTW riders (71.5%), followed by Participants A being M1/N1 vehicle drivers (19.0%). Participant B caused 8.5% of all accidents, and more specifically, 7.0% was caused by Participants B being M1/N1 vehicles (Figure 13).

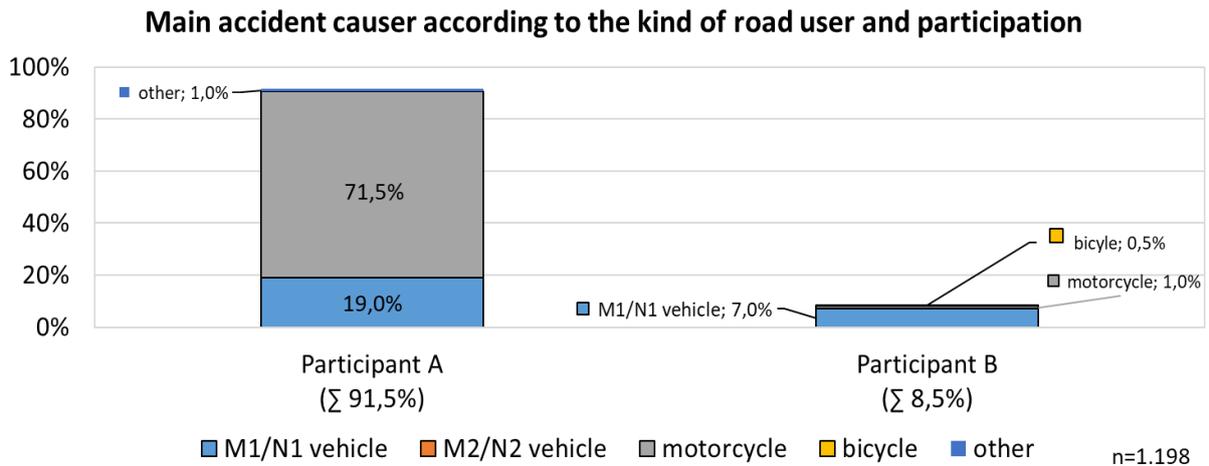


Figure 13: Main accident causer (601 & 602)

At the accident types 611 & 612, the majority (98.8%) of PTW accidents are caused by Participant A. The most frequent accident causers are PTW riders (75.8%), then M1/N1 vehicle drivers (20.8%). The Participant B caused 1.2% of all accidents, all of this 1.2% are PTW riders (Figure 14).

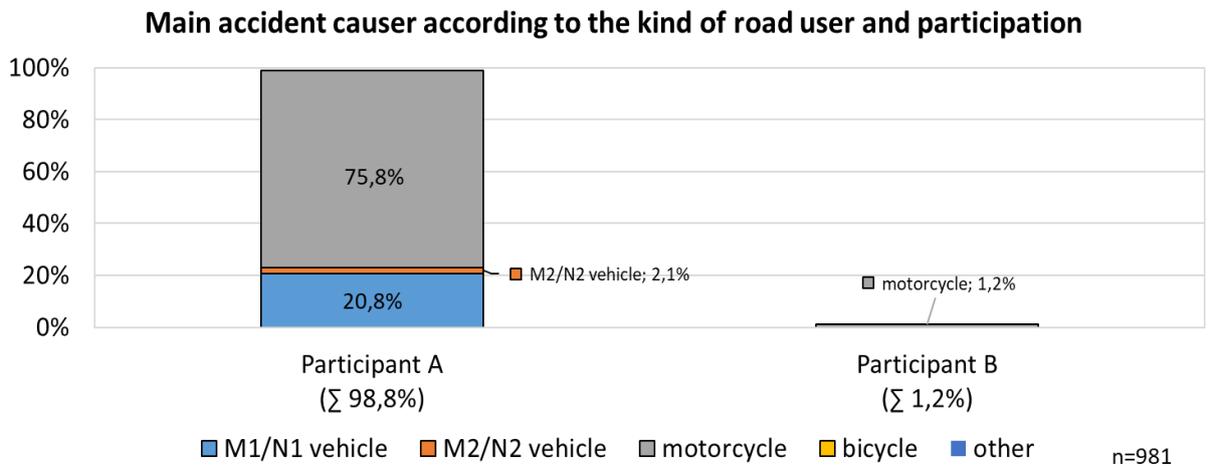


Figure 14: Main accident causer (611 & 612)

5.1.6 f) Main accident causation

At the accident types 601 & 602, 42.7% of PTW accidents are caused by not keeping enough distance between the participants (Participant A: 40.7%, Participant B: 2.0%). Then, 30.8% is caused by other mistakes by the driver/rider (Participant A: 29.3%, Participant B: 1.5%). Then, 18.6% of the accidents are caused by speeding of Participant A. Furthermore, Participant B caused accidents by turning (2%), by driving past (1.5%), or by overtaking (0.5%) (Figure 15).

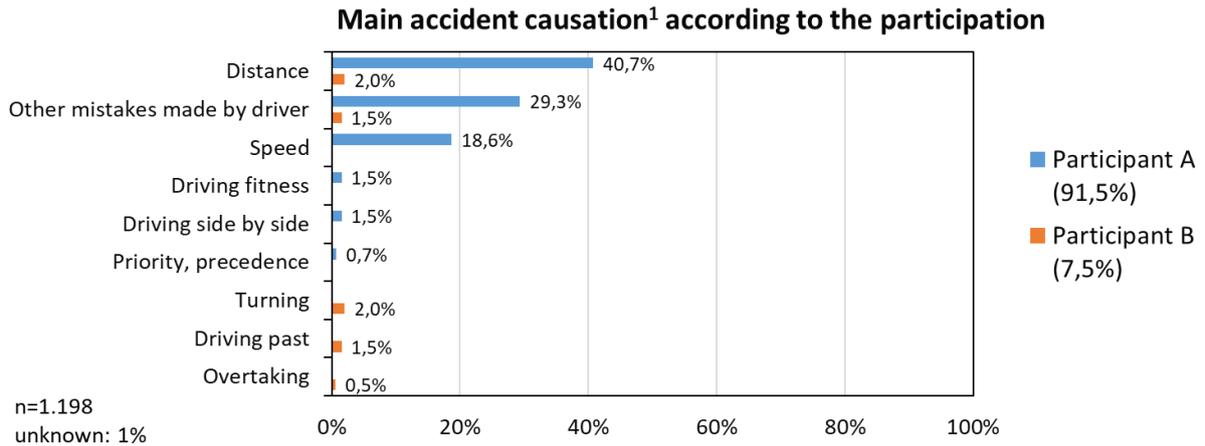


Figure 15: Main accident causation (601 & 602)

At the accident types 611 & 612, 44.0% of PTW accidents are caused by not keeping enough distance between the participants by Participant A. Then, 33.6% is caused by other mistakes by the driver/rider, and 21.1% of the accidents are caused by speeding. A small number (1.2%) of the main accident causations are unknown, that is why there is no data of the main accident causation according to Participant B (Figure 16).

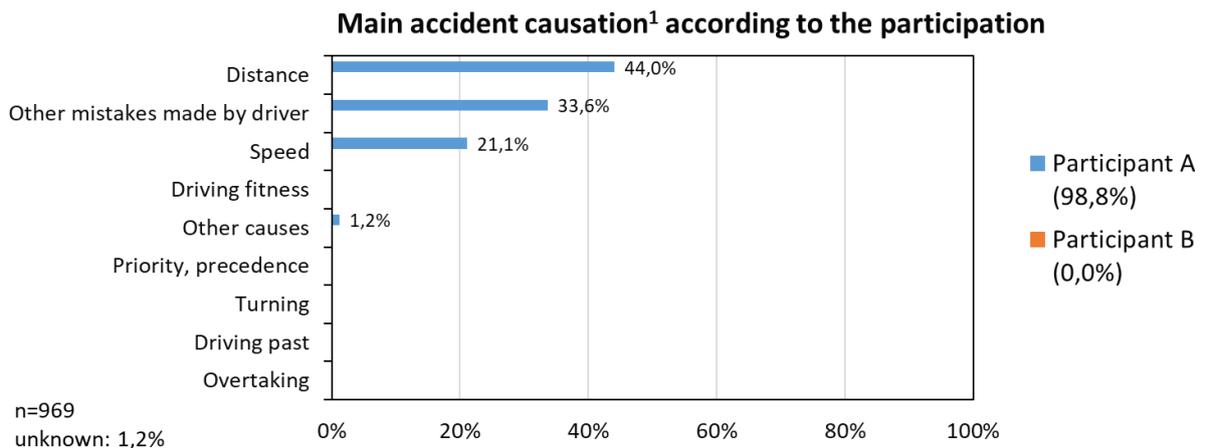


Figure 16: Main accident causation (611 & 612)

1: The police and also the technical investigation units in GIDAS have to assign a main accident causer with one main accident causation in each accident.

The multiple accident causations by participant are shown in Figure 17 and Figure 18. At the accident types 601 & 602, in half of the cases (49.1%), one of the reasons is Participant A not keeping enough distance. Every third accident is caused either by other mistakes made by Participant A (36.8%) or by speeding (35.9%). Less frequent causations are Participant B not keeping the enough distance (5.8%), other mistakes made by the driver (4.8%) or turning (2.8%) (Figure 17).

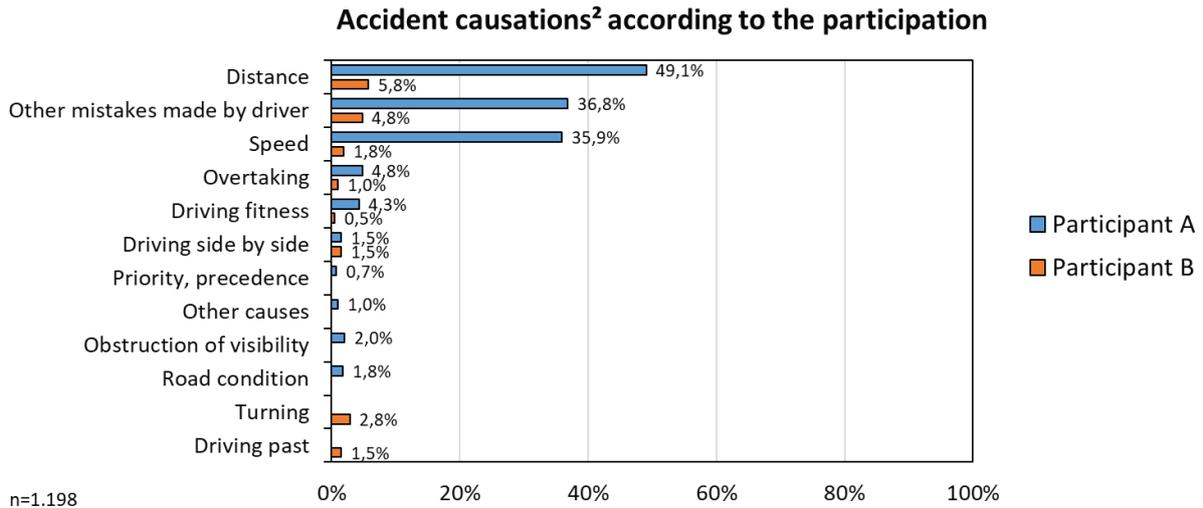


Figure 17: Accident causations (601 & 602)

At the accident types 611 & 612, looking at the most frequently mentioned causes for the accident, Participant A did not keep enough distance in more than half (57.2%) of cases. Also frequently mentioned are other mistakes made by Participant A (48.6%) and speed of Participant A (33.9%) (Figure 18).

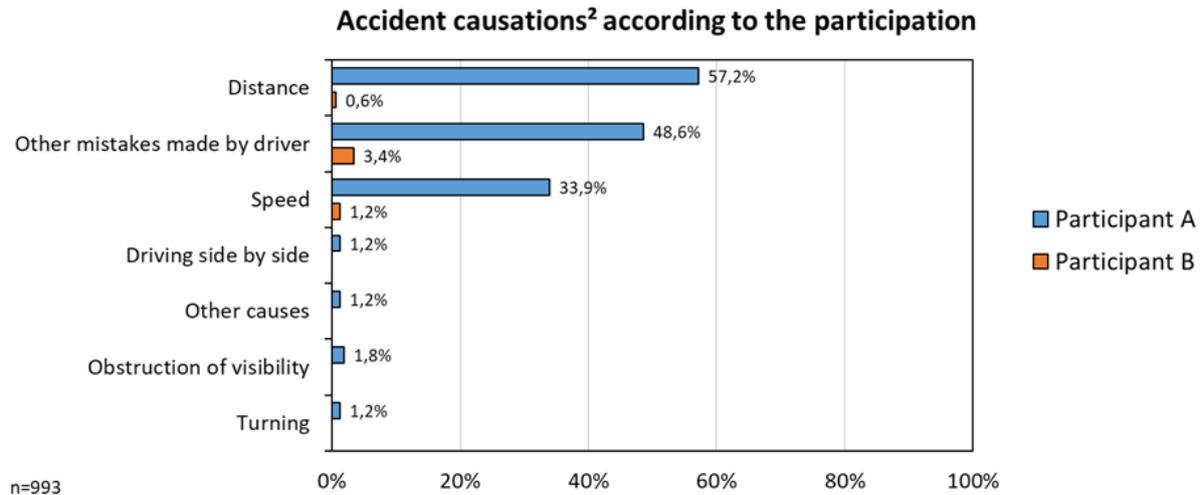


Figure 18: Accident causations (611 & 612)

2: The police and the technical investigation units in GIDAS can assign up to 3 accident causations for each accident participant. Consequently, one accident can have several accident causes depending on the participant and so the sum of the accident causations is $\geq 100\%$.

5.1.7 g) Types of speed limitation

The type of speed limitation of each participant is shown in Figure 19 and Figure 20. At the accident types 601 & 602, the majority (61.7%) of PTW accidents occurred on accident scenes with a speed limitation by the locality. Secondly, almost every third accident location is limited by a speed sign. In comparison between Participant A and B there are no significant differences (Figure 19).

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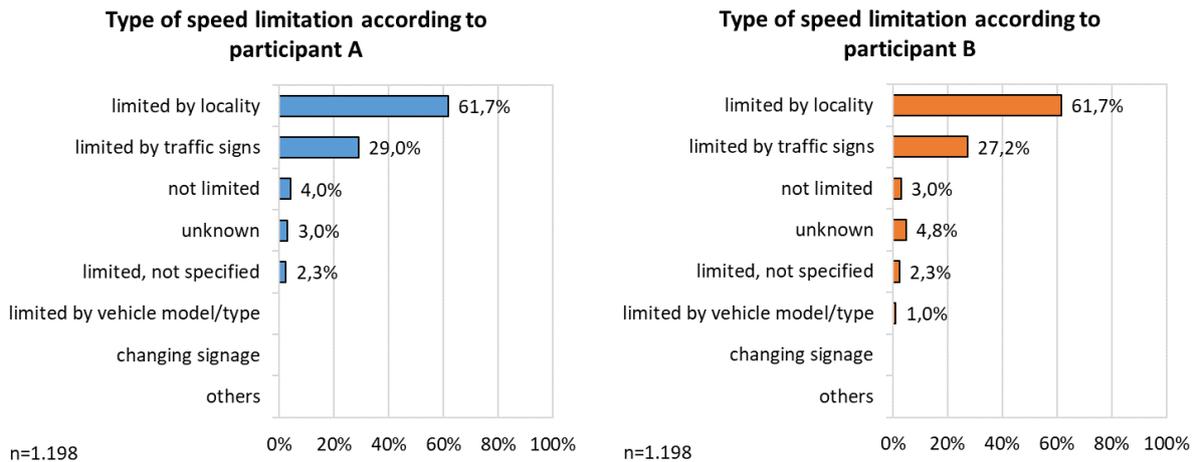


Figure 19: Types of speed limitation for the participants (601 & 602)

At the accident types 611 & 612, regardless of participation, the most common type of speed limitation in PTW accidents are limitations by locality (Participant A: 48.6%, Participant B: 46.5%) and limitation by traffic signs (Participant A: 37.6%, Participant B: 41.0%) (Figure 20).

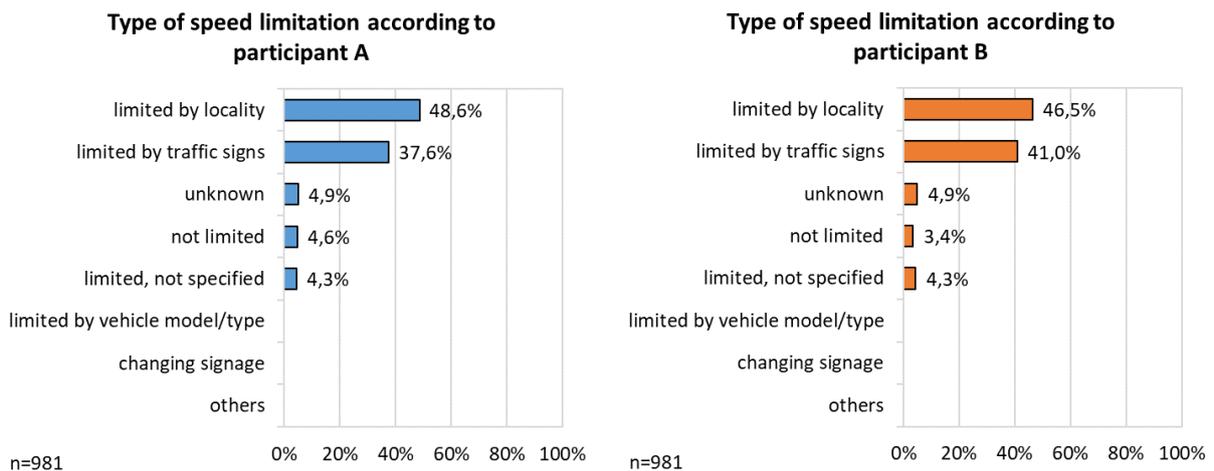


Figure 20: Types of speed limitation for the participants (611 & 612)

5.1.8 h) Maximum permitted speed

The maximum permitted speed on the accident site, for accident types 601 & 602, is shown in Figure 21. The most frequently permitted maximum speed is 50 km/h since most accidents happened on urban roads.

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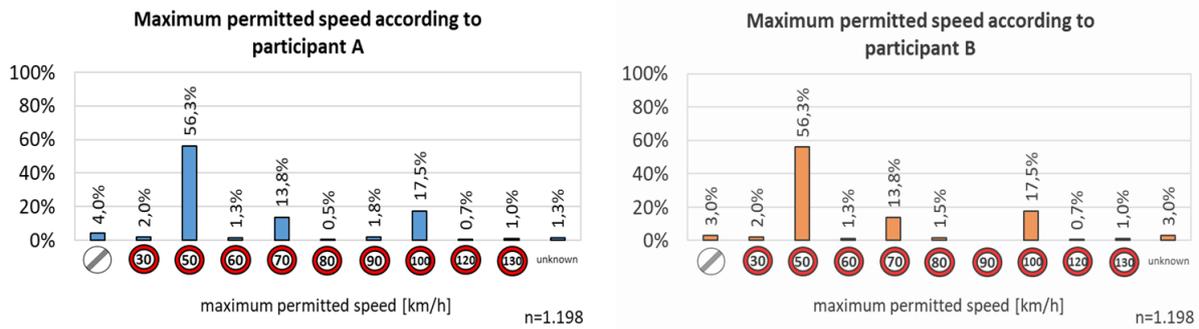


Figure 21: Maximum permitted speed (601 & 602)

At the accident types 611 & 612, the most frequent maximum permitted speed is 50 km/h since most accidents happened on urban roads (Figure 22).

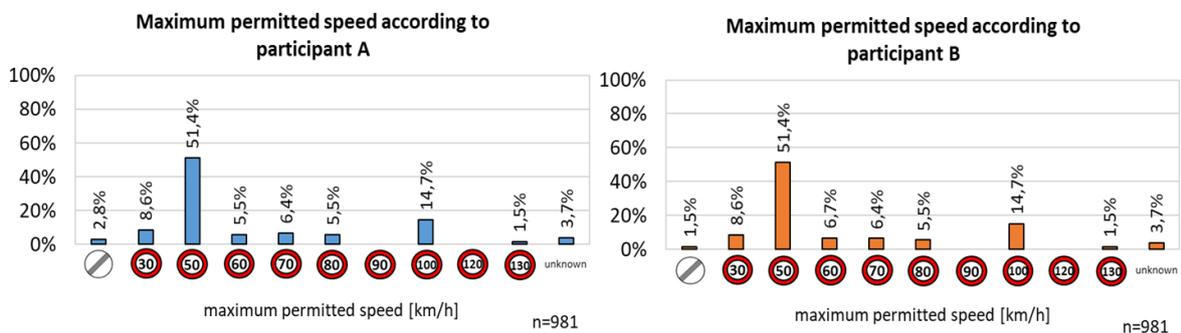


Figure 22: Maximum permitted speed (611 & 612)

5.1.9 i) Speed limit and distribution

At the accident types 601 & 602, every fourth Participant A exceeds the speed limit, especially at speed limits of 50 km/h, 70 km/h and 100 km/h. In comparison, only 5.5% of Participants B exceeds the speed limit (Figure 23).

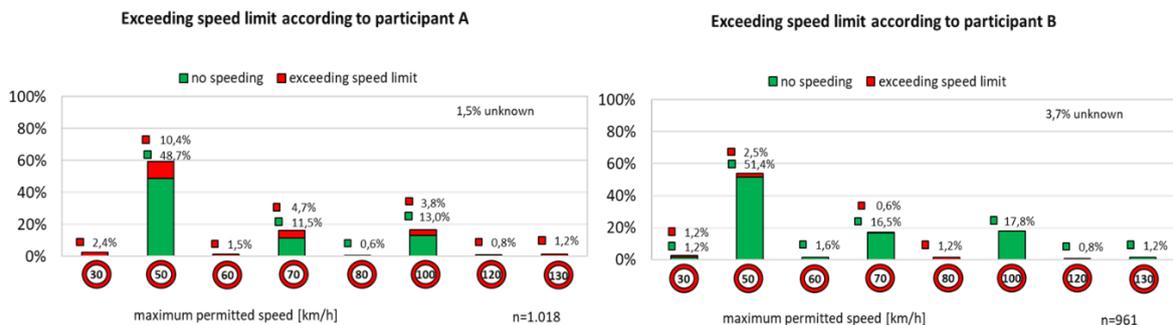


Figure 23: Exceeding the speed limit (601 & 602)

At the accident types 611 & 612, every fourth Participant A exceeds the speed limit, especially at speed limits of 30 km/h, 50 km/h and 100 km/h. In comparison only 1.5% of Participants B exceeds the speed limit (Figure 24).

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Figure 24: Exceeding the speed limit (611 & 612)

The distribution of how much Participant A exceeded the allowable speed for each given speed limit before reaching the point of the incident is shown in Figure 25 and Figure 26.

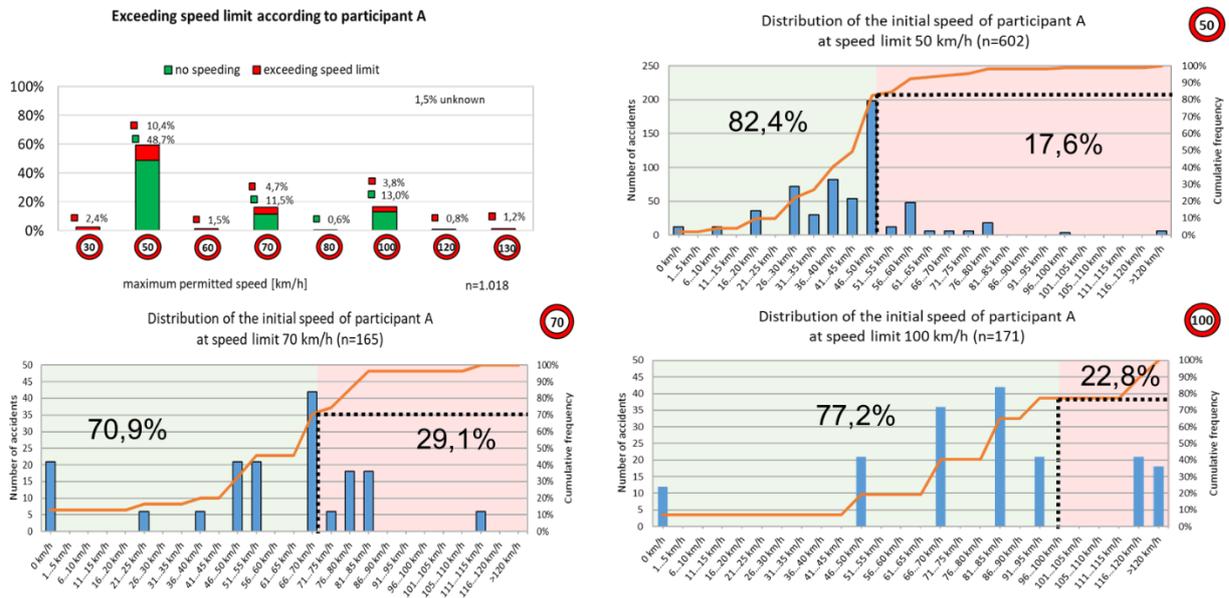


Figure 25: Speed distribution by Participant A (601 & 602)

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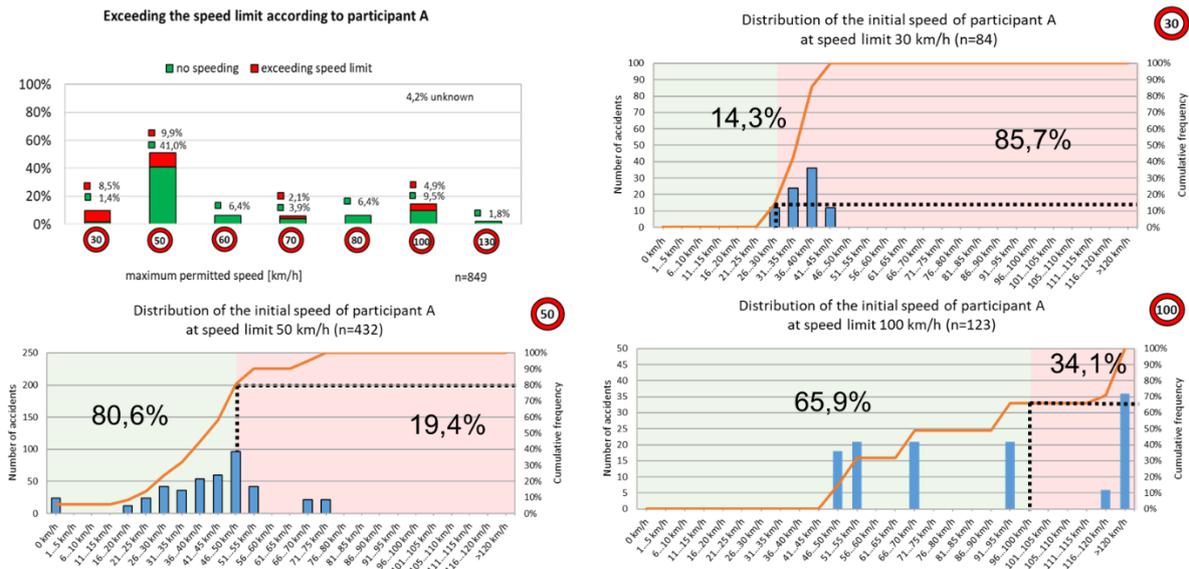


Figure 26: Speed distribution by Participant A (611 & 612)

5.1.10 j) Speed before the accident and at the time of collision

The initial speed of each participant is shown in Figure 27 and Figure 28.

At the accident types 601 & 602, the comparison of the initial speeds of Participant A and B show, that the initial speeds of Participant A are higher on average but not so different. Specifically, the median of the average initial speeds of Participant A is 50 km/h and of Participant B is 40 km/h (Figure 27).

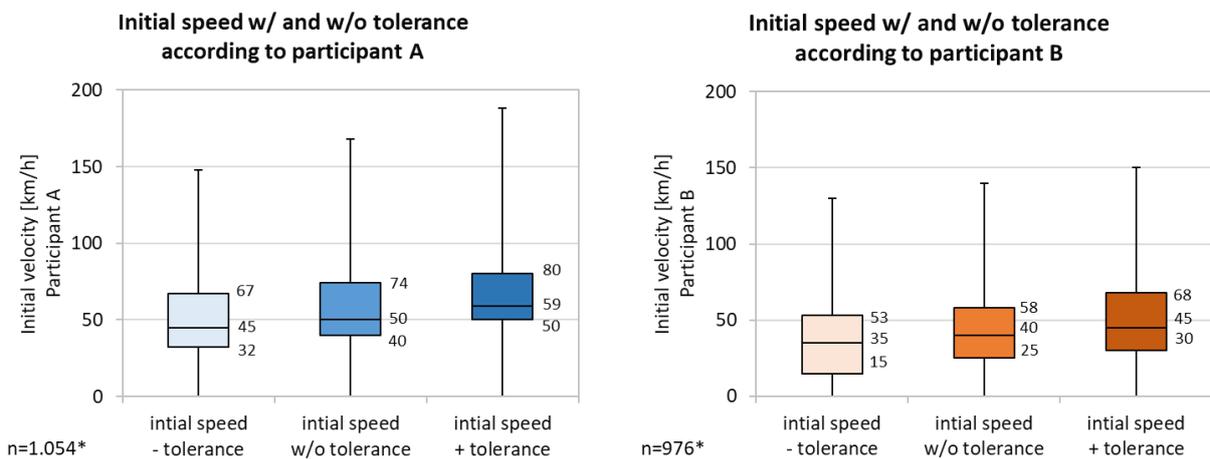


Figure 27: Initial speed of participants (601 & 602)

At the accident types 611 & 612, the median of the initial speed of Participant A is 50 km/h and that of Participant B is 30 km/h (Figure 28). Compared to accident type 601 & 602, the median initial speed of Participant A is the same, but that of Participant B is 10 km/h lower, because Participant B is driving in a traffic congestion at the accident types 611 & 612.

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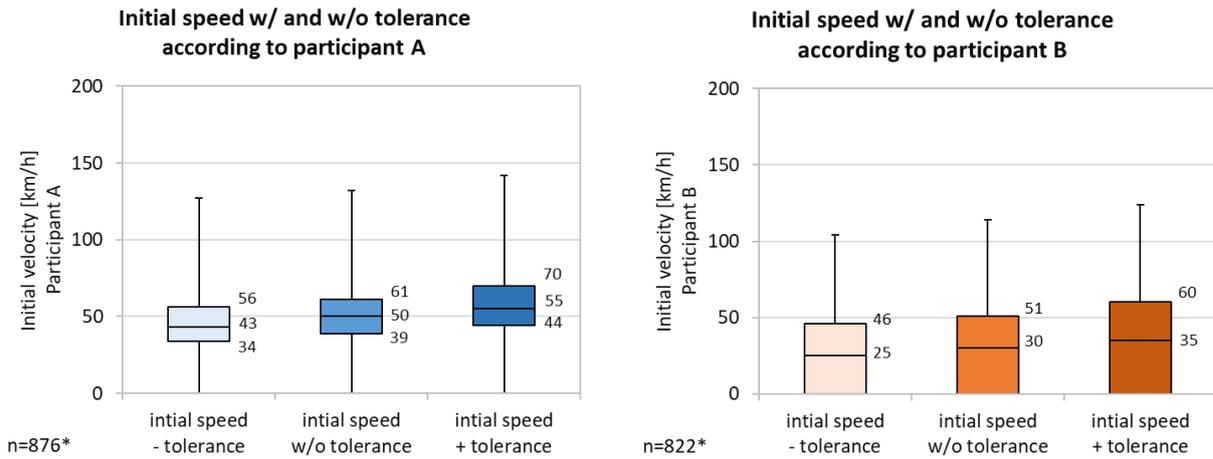


Figure 28: Initial speed of participants (611 & 612)

The initial speed of each participant if the main accident causer is a PTW is shown in Figure 29 and Figure 30.

At the accident types 601 & 602, if the main accident causer is a PTW, compared to the initial speeds without differentiation of the main accident causer (Figure 27), then the speeds of both participants are slightly higher. (Participant A: 54 km/h, Participant B: 45 km/h). (Figure 29).

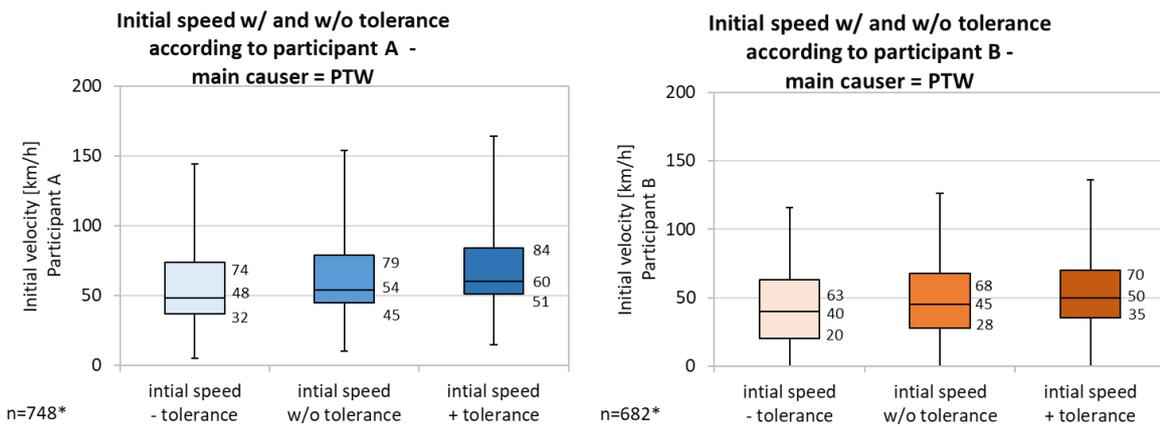


Figure 29: Initial speed of participants if the main accident causer is a PTW (601 & 602)

At the accident types 611 & 612, if the main accident causer is a PTW, compared to the initial speeds without differentiation of the main accident causer (Figure 28), then the median speed of Participant A is the same and the median speed of Participant B is 7 km/h higher (Figure 30).

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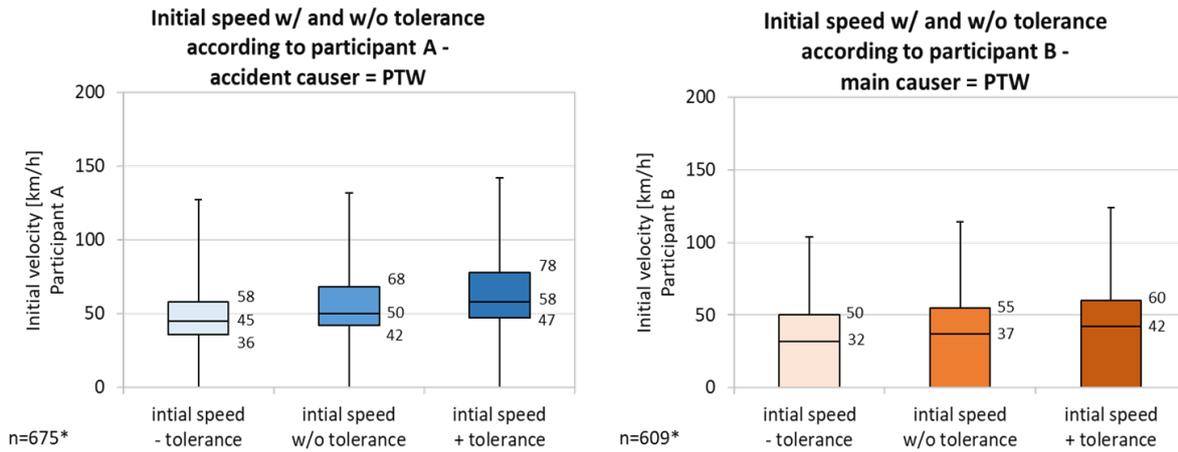


Figure 30: Initial speed of participants if the main accident causer is a PTW (611 & 612)

The initial speed of each participant if the main accident causer is not a PTW is shown in Figure 31 and Figure 32.

At the accident types 601 & 602, if the main accident causer is not a PTW, compared to the initial speeds without differentiation of the main accident causer (Figure 27), the median speed of Participant A is 1 km/h lower and of Participant B 10 km/h lower (Figure 31).

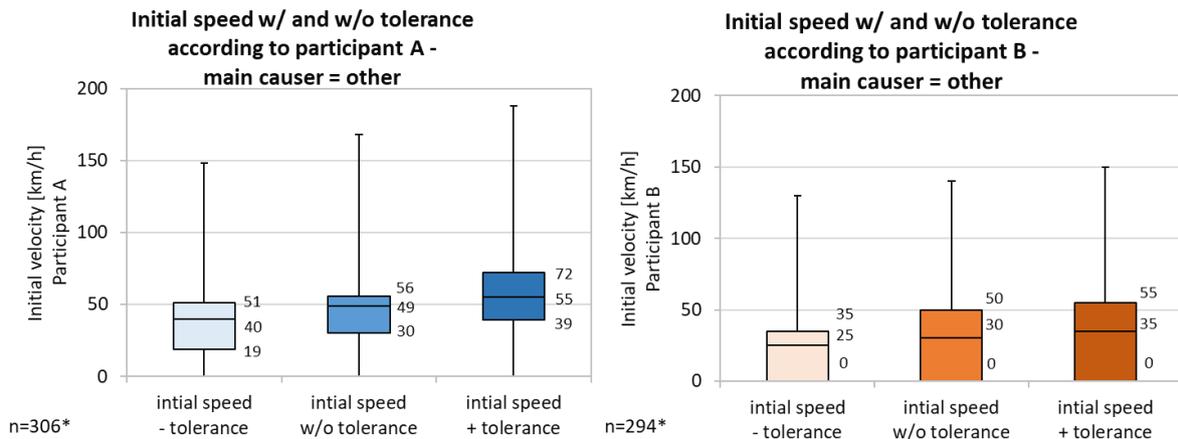


Figure 31: Initial speed of participants if the main accident causer is not a PTW (601 & 602)

At the accident types 611 & 612, if the main accident causer is not a PTW, compared to the initial speeds without differentiation of the main accident causer (Figure 28), the median speed of Participant A is 3 km/h lower and the median speed of Participant B is 10 km/h lower (Figure 32).

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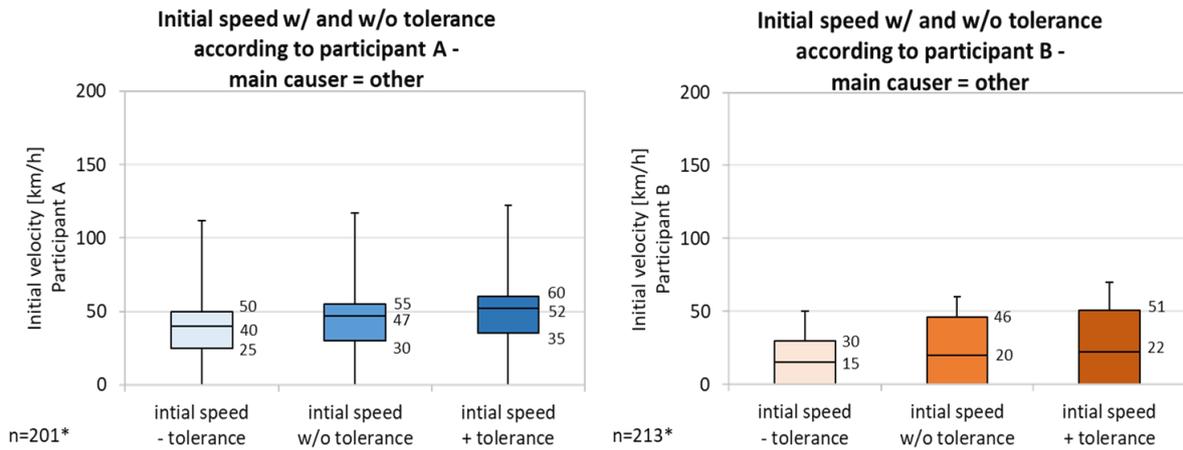


Figure 32: Initial speed of participants if the main accident causer is not a PTW (611 & 612)

The collision speed of each participant is shown in Figure 33 and Figure 34.

At the accident types 601 & 602, the comparison between the collision speeds show that the Participants A have a higher collision speed on average than the Participants B (Figure 33). On the other hands, the comparison between the initial speeds (Figure 27) and collision speeds show that the Participants B decelerate more than Participants A (Participant A: from 50 km/h to 38 km/h, Participant B: from 40 km/h to 10 km/h).

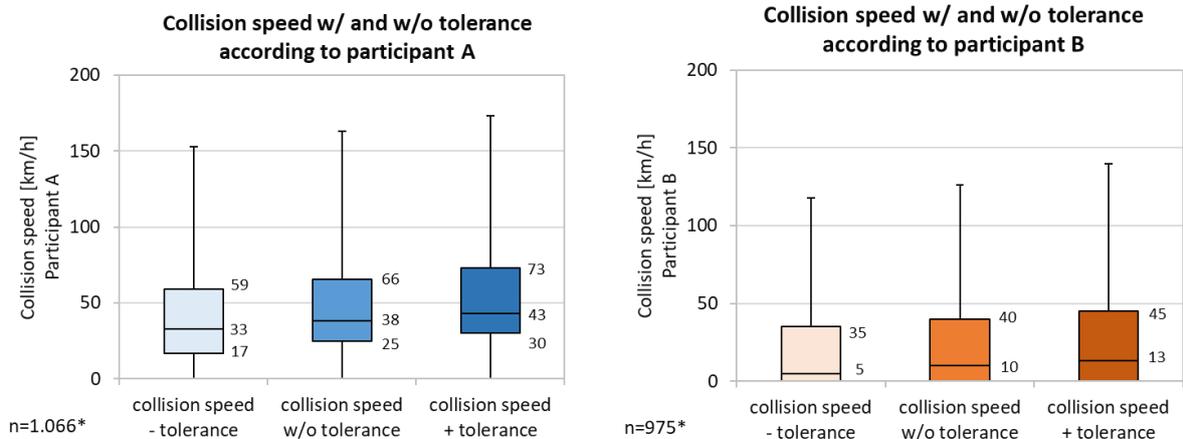


Figure 33: Collision speed of participants (601 & 602)

At the accident types 611 & 612, the comparison between the collision speeds show that the Participants A have a higher collision speed on average than the Participants B (Participant A: 35 km/h, Participant B: 0 km/h). When Participant A collided with Participant B, almost all Participants B have already stopped. Compared to accident type 601 & 602, the median collision speed of Participant A is 3 km/h lower and that of Participant B 10 km/h lower (Figure 34).

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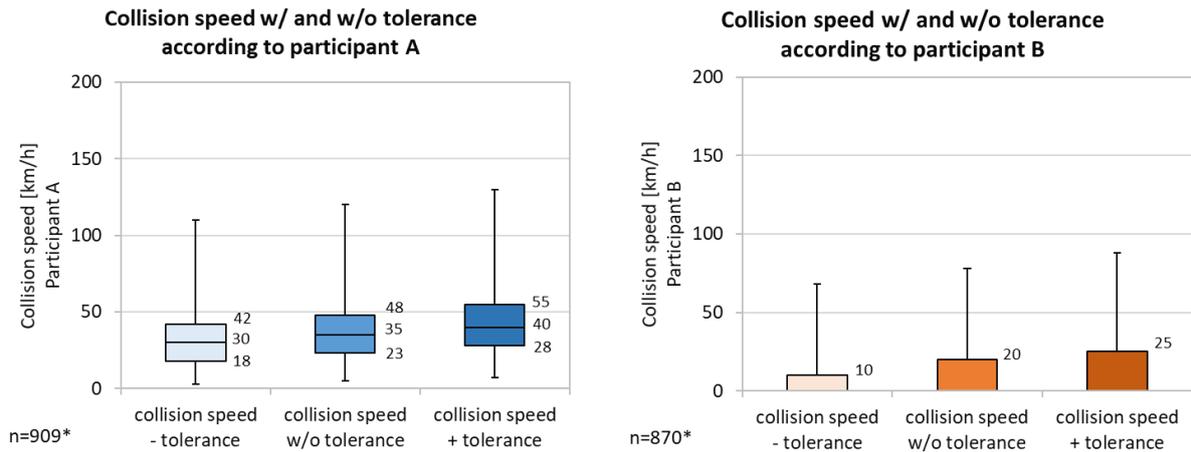


Figure 34: Collision speed of participants (611 & 612)

The collision speed of each participant if the main accident causer is a PTW is shown in Figure 35 and Figure 36.

At the accident types 601 & 602, If the accident main causer is a PTW, compared to the collision speeds without differentiation of the main accident causer (Figure 33), then the median speed of Participant A is 1 km/h lower and the median speed of Participant B does not change (10 km/h) (Figure 35).

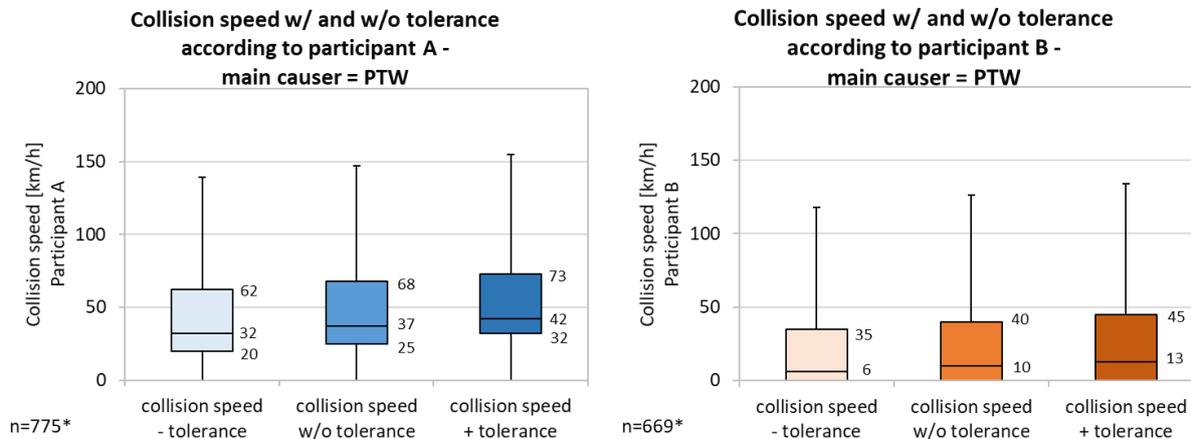


Figure 35: Collision speed of participants if the main accident causer is a PTW (601 & 602)

At the accident types 611 & 612, If the accident main causer is a PTW, compared to the collision speeds without differentiation of the main accident causer (Figure 34), then there are no changes in the median speeds of Participants A (35 km/h) and B (0 km/h) (Figure 36).

Accident Analysis – Longitudinal Traffic

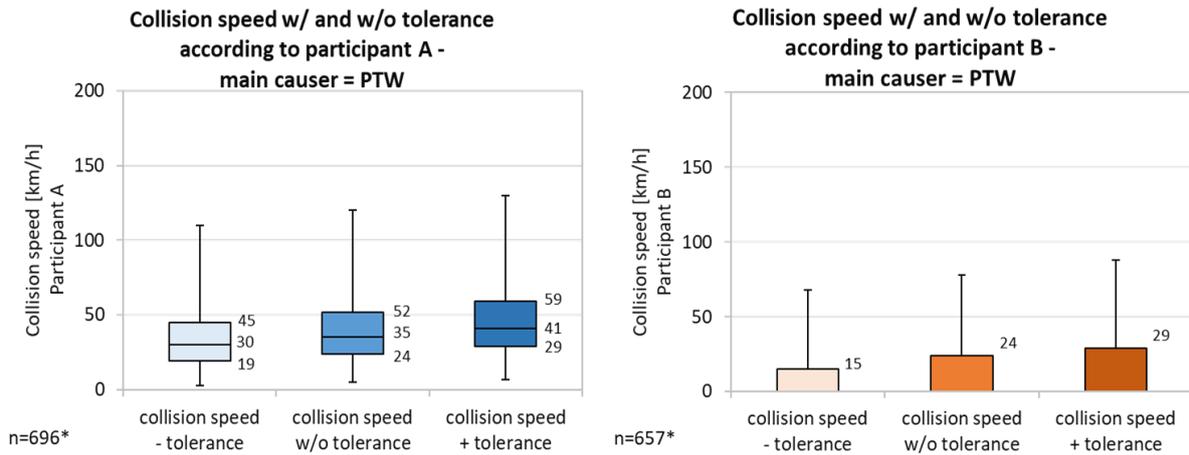


Figure 36: Collision speed of participants if the main accident causer is a PTW (611 & 612)

The collision speed of each participant if the main accident causer is not a PTW is shown in Figure 37 and Figure 38.

At the accident types 601 & 602, if the main accident causer is not a PTW, compared to the collision speeds without differentiation of the accident main causer (Figure 33), then the median speed of Participant A is 2 km/h lower and for Participant B nothing changes (10 km/h) (Figure 37).

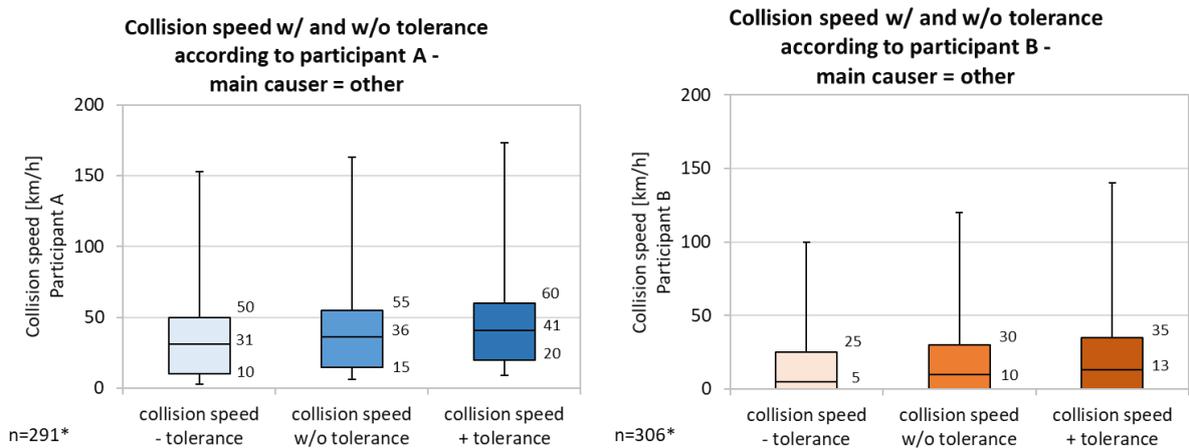


Figure 37: Collision speed of participants if the main accident causer is not a PTW (601 & 602)

At the accident types 611 & 612, if the main accident causer is not a PTW, compared to the collision speeds without differentiation of the main accident causer (Figure 34), then the median speed of Participant A is 10 km/h lower and the median speed of Participant B does not change (Figure 38). At the accident types 611 & 612, almost all the main accident causers are Participants A (Figure 14), therefore “the main accident causer is not a PTW” means that another kind of vehicle collides into the rear end of a PTW. In this case, Participant A decelerates 22 km/h before collision (from 47 km/h to 25 km/h). On the other hands, without differentiation of the main accident causer, Participant A decelerates 15 km/h (from 50 km/h to 35 km/h). This leads to the conclusion that other kinds of vehicles decelerate more than PTWs at the accident types 611 & 612. Figure 16

Accident Analysis – Longitudinal Traffic

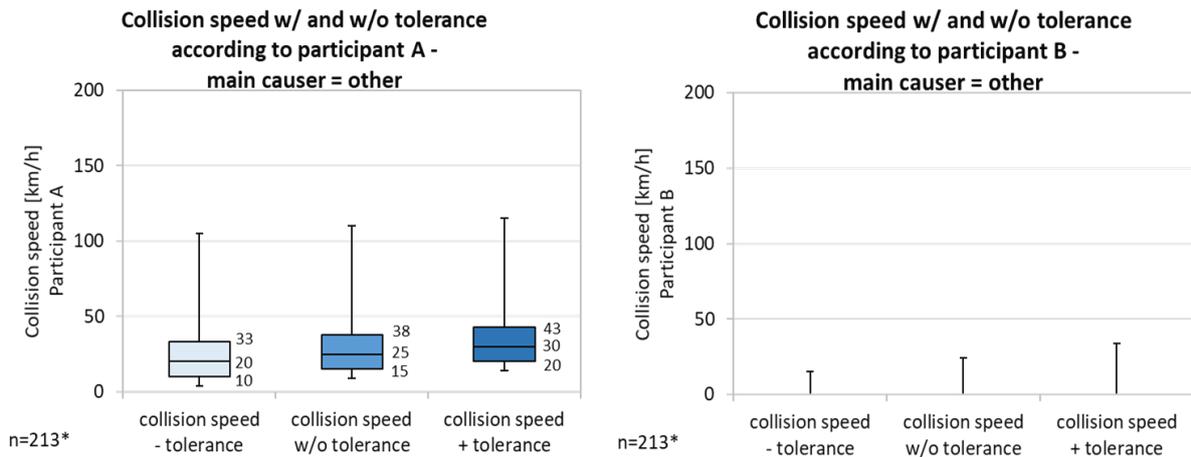


Figure 38: Collision speed of participants if the main accident causer is not a PTW (611 & 612)

5.1.11 k) View obstruction

The existence of view obstructions for each participant are shown in Figure 39 and Figure 40. At the accident types 601 & 602, the majority of participants had no view obstructions (Participant A: 90.2%, Participant B: 93.5%). Among the approximately 4% of all Participants A that were affected by view obstructions, a majority of them reported permanent ones (Figure 39).

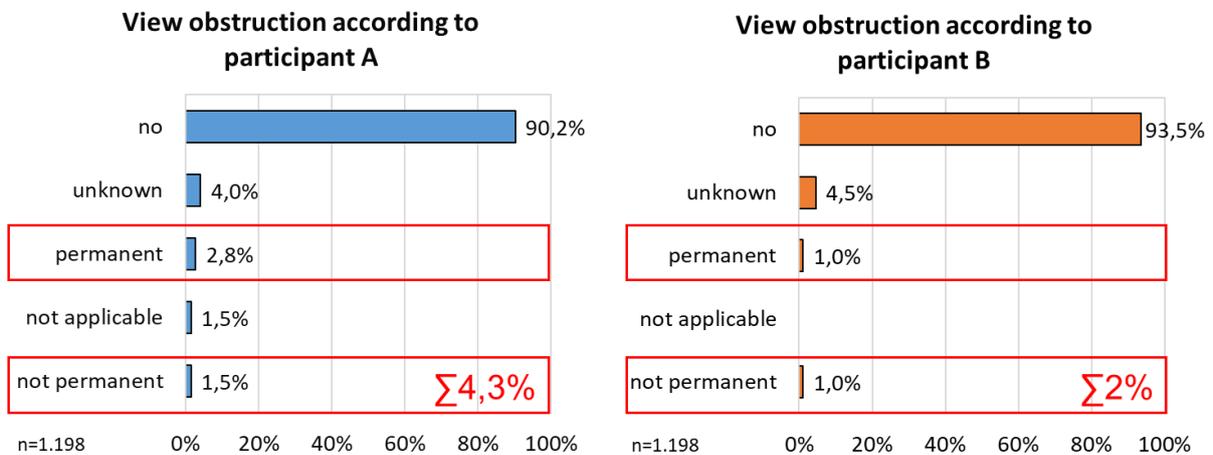


Figure 39: View obstruction (601 & 602)

At the accident types 611 & 612, the majority of participants had no view obstruction (Participant A: 94.8%, Participant B: 98.2%). Among the approximately 5% of all Participants A that were affected by view obstructions, a majority of them reported non-permanent ones (Figure 40).

Accident Analysis – Longitudinal Traffic

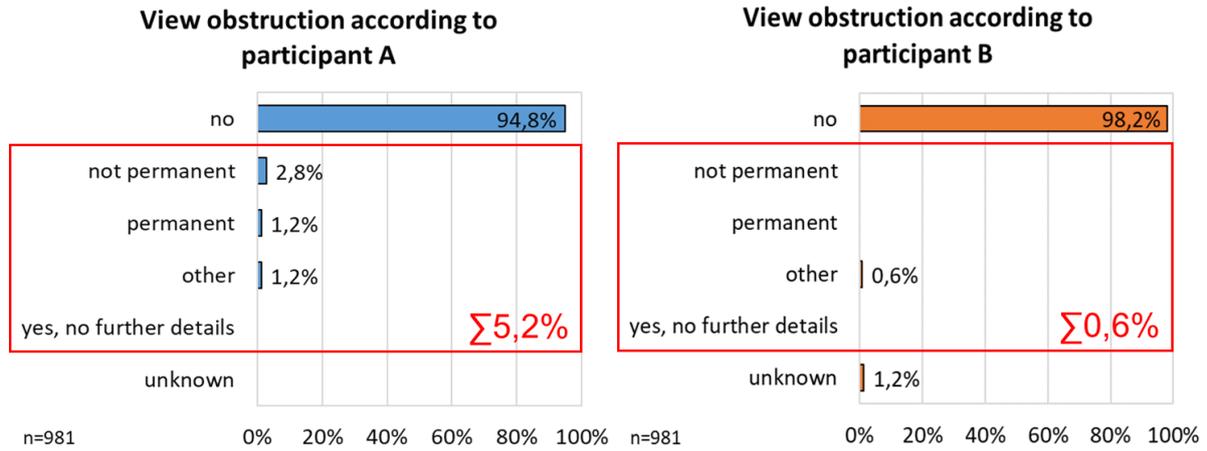


Figure 40: View obstruction (611 & 612)

The type of view obstruction for each participant is shown in Figure 41 and Figure 42. At the accident types 601 & 602, the rare view obstructions for Participant A were structural circumstances (e.g., buildings), followed by parking and waiting/starting vehicles ($\Sigma 3.3\%$). In case Participants B were obstructed, it was due to parking vehicles or other view obstructions (each 1.0%) (Figure 41).

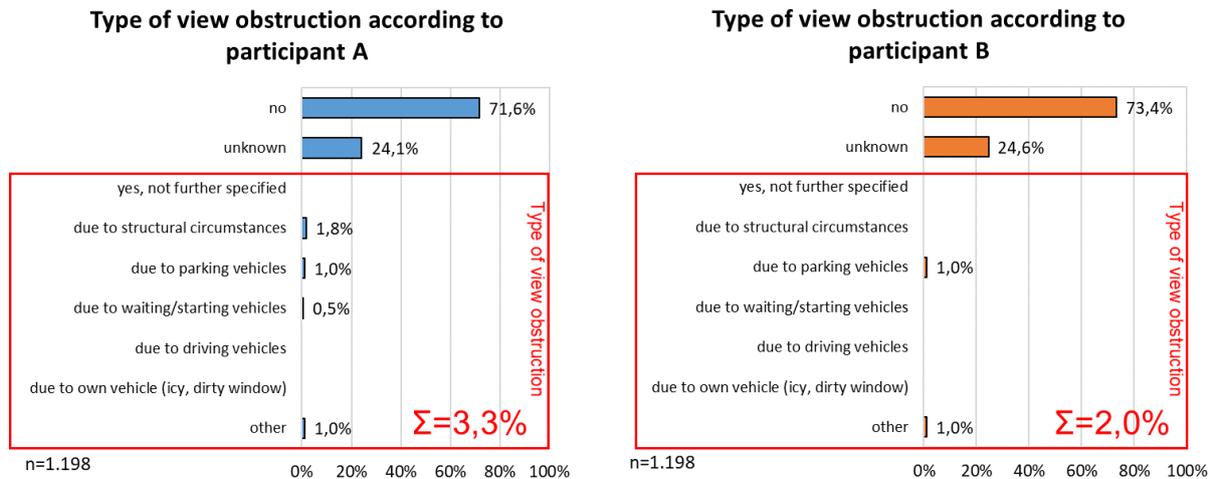


Figure 41: Type of view obstruction (601 & 602)

At the accident types 611 & 612, the most frequent view obstruction according to Participant A is due to driving vehicles (2.1%) (Figure 42).

Accident Analysis – Longitudinal Traffic

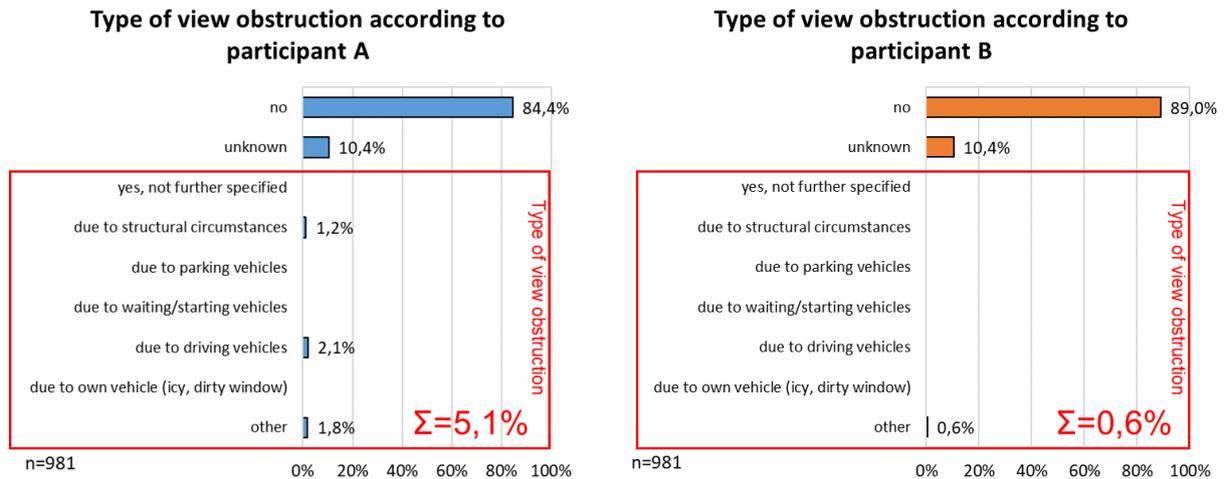


Figure 42: Type of view obstruction (611 & 612)

5.1.12 I) Used lane when encountering an accident

Figure 43 and Figure 44 show which lane the participants used when encountering an accident. At the accident types 601 & 602, for both participants, the most common situation is being on a single lane road (Participant A and Participant B: both 48.4%) (Figure 43).

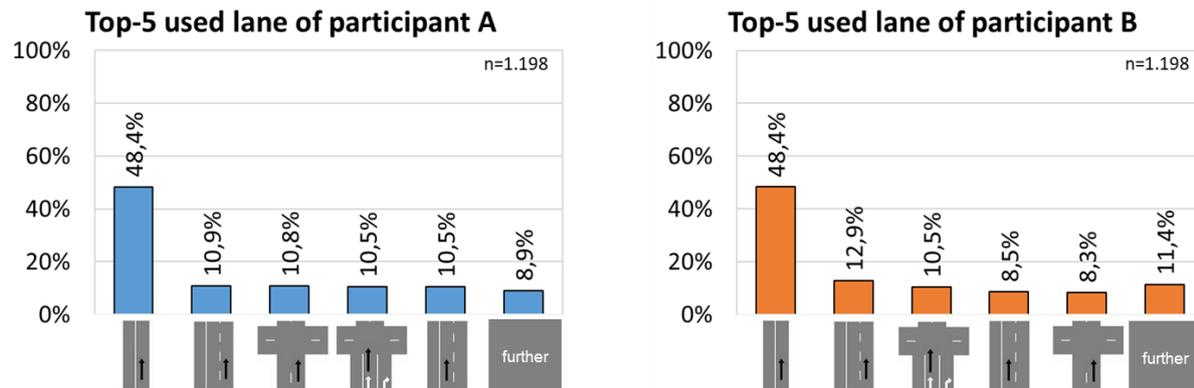


Figure 43: Used lane at an accident (601 & 602)

At the accident types 611 & 612, for both participants, the most common situation is being on a single lane road (Participants A and B: both 49.5%), then on the left lane of the two-lane road (Participants A and B: both 19.3%) (Figure 44).

Accident Analysis – Longitudinal Traffic

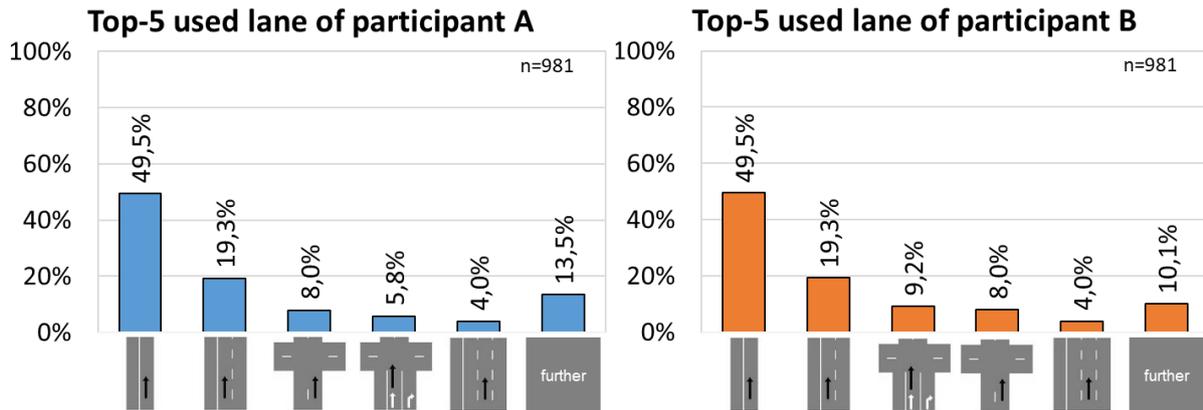


Figure 44: Used lane at an accident (611 & 612)

The used lane when encountering an accident if the main accident causer is a PTW is shown in Figure 45 and Figure 46.

At the accident types 601 & 602, if the accident main causer is a PTW, the most common situation is being on single lane road (Participants A and B: both 50.6%) (Figure 45). Compared to the used lane without differentiation of the main accident causer (Figure 43), then the rate of single lane road is slightly higher but overall, the used lane is almost the same.

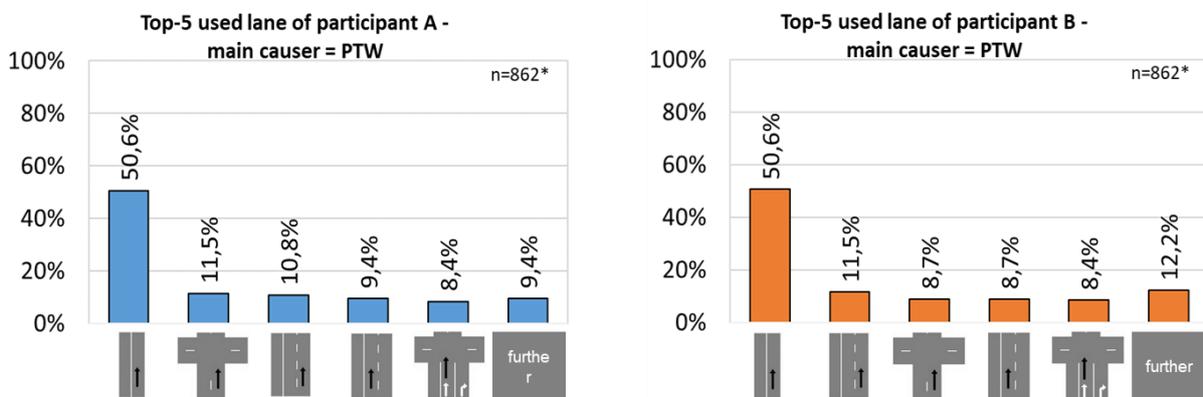


Figure 45: Used lane at an accident if the main accident causer is a PTW (601 & 602)

At the accident types 611 & 612, if the accident main causer is a PTW, the most common situation is being on single lane road (Participants A and B: both 52.4%) (Figure 46).

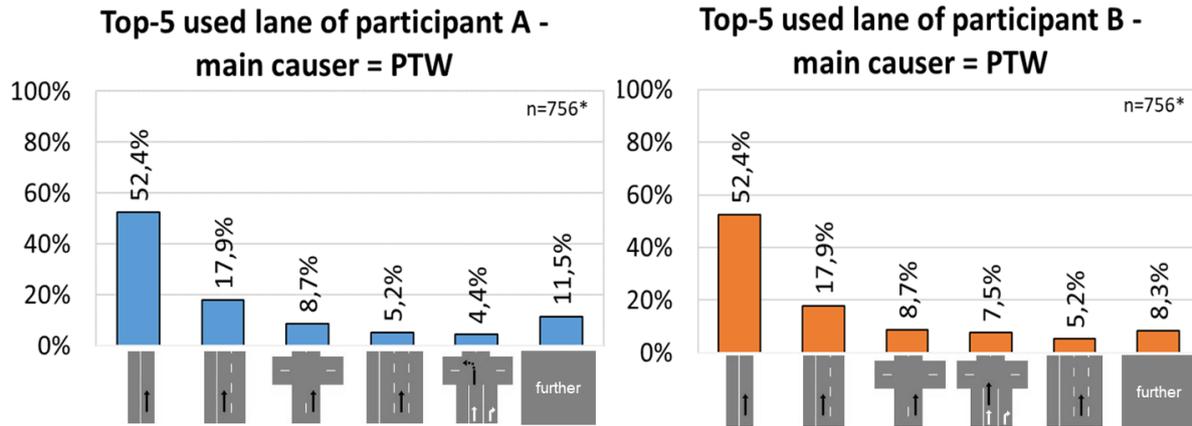


Figure 46: Used lane at an accident if the main accident causer is a PTW (611 & 612)

The used lane when encountering an accident if the main accident causer is not a PTW is shown in Figure 47 Figure 45 and Figure 48.

At the accident types 601 & 602, if the accident main causer is not a PTW, the most common situation is being on single lane road (Participants A and B: both 42.9%) (Figure 47).

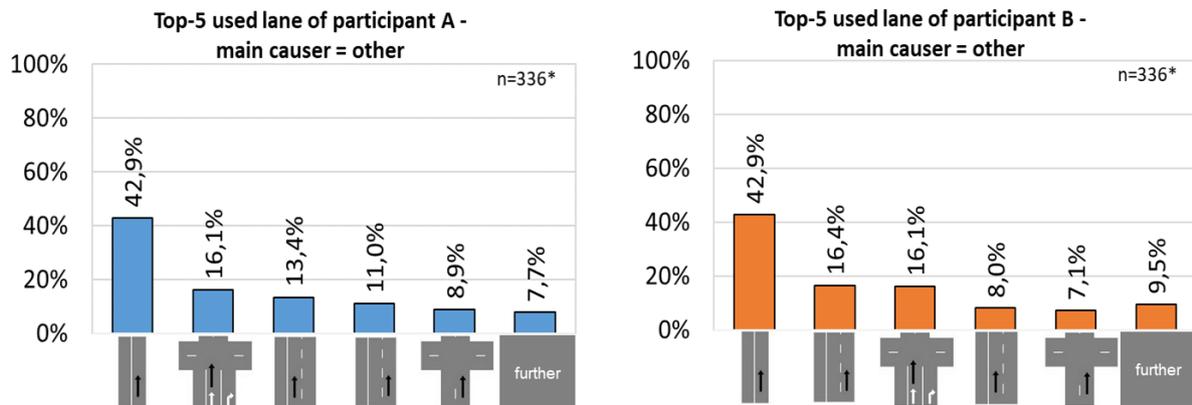


Figure 47: Used lane at an accident if the main accident causer is not a PTW (601 & 602)

At the accident types 611 & 612, if the main accident causer is not a PTW, the most common situation is being on single lane road (Participants A and B: both 40%) (Figure 48). The second most common situation, that of both participants driving on the left lane of a two-lane road, is occurring with a higher percentage (Participants A and B: both 24%) than in the case of a PTW being the main accident causer (Participants A and B: both 17.9%) (Figure 46). In other words, if the main accident causer is not a PTW, compared with the situation where the main accident causer is a PTW, then the rate of using a single lane road decreases and the rate of using the left lane of a two-lane road increases.

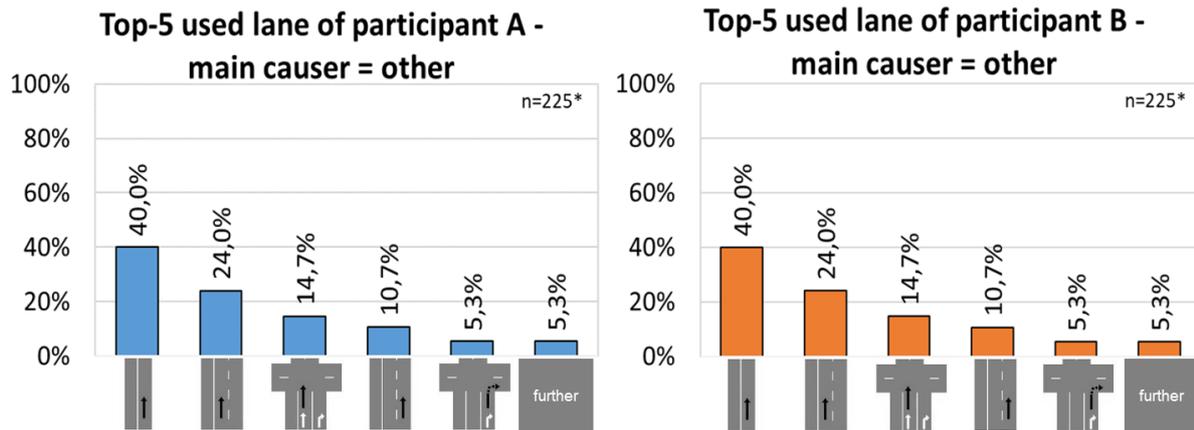


Figure 48: Used lane at an accident if the main accident causer is not a PTW (611 & 612)

5.1.13 m) Road surface

Figure 49 and Figure 50 show which kind of road surface it was when encountering the accident.

At the accident types 601 & 602, most accidents happened on conventional asphalt (Participant A: 82.6%, Participant B: 83.6%), followed by non-specified asphalt (Participant A and B: 12.9%) (Figure 49).

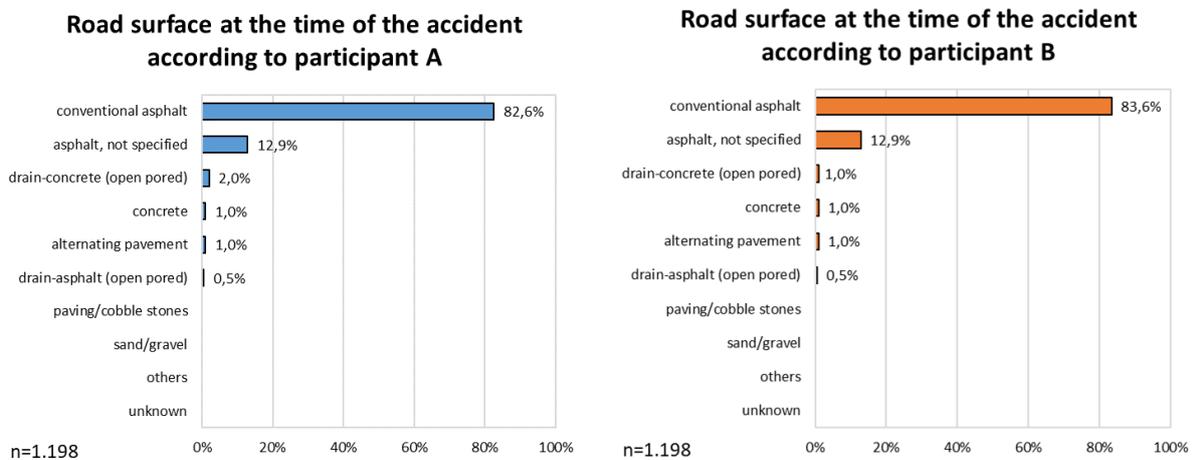


Figure 49: Road surface (601 & 602)

At the accident types 611 & 612, most accidents happened on conventional asphalt (Participant A: 85.3%, Participant B: 84.1%). In comparison between the participants there are no significant differences (Figure 50).

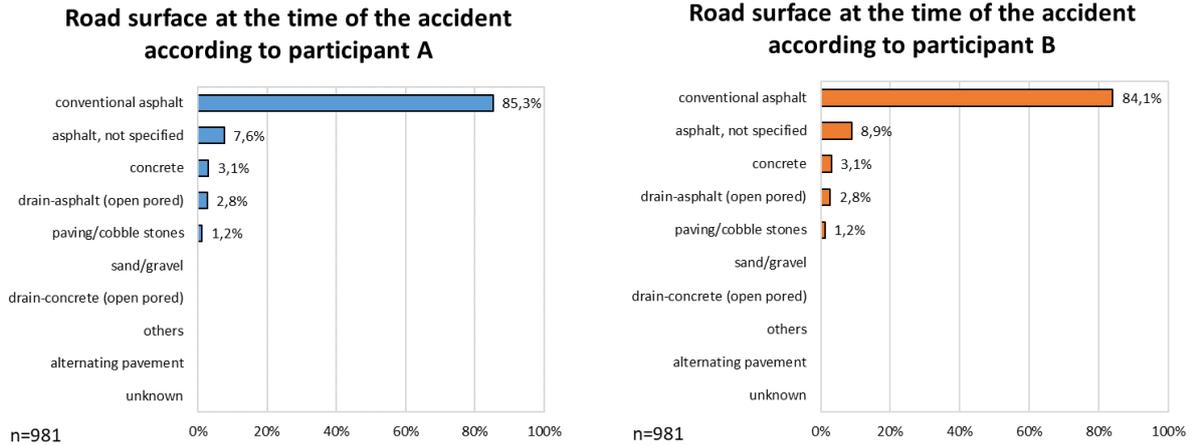


Figure 50: Road surface (611 & 612)

5.1.14 n) Precipitation at the time of the accident

Figure 51 and Figure 52 show the occurrence of precipitation at the time of the accident. At the accident types 601 & 602, most accidents (98%) occurred without precipitation. The only occurring type of precipitation was rainfall (2%) (Figure 51).

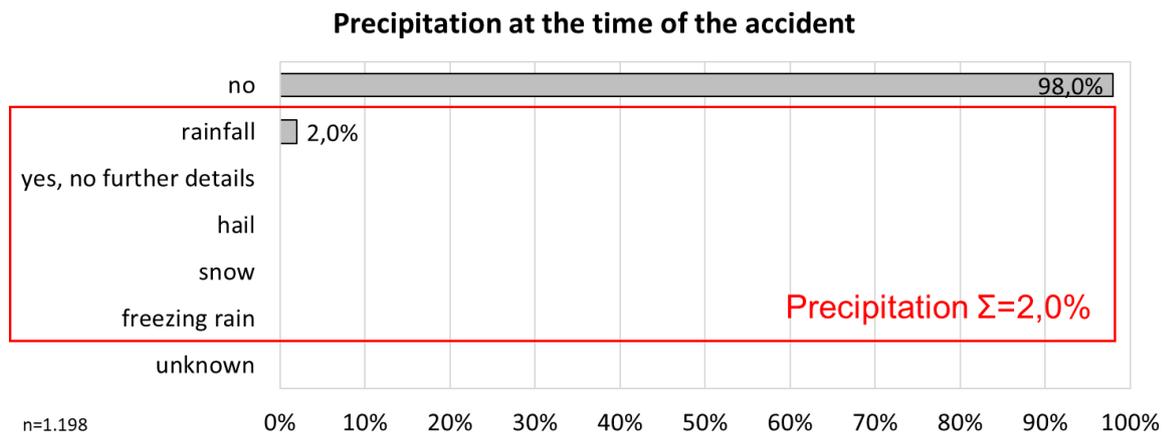


Figure 51: Precipitation (601 & 602)

At the accident types 611 & 612, most accidents (95.1%) occurred without precipitation. The only occurring type of precipitation was rainfall (4.9%) (Figure 52).

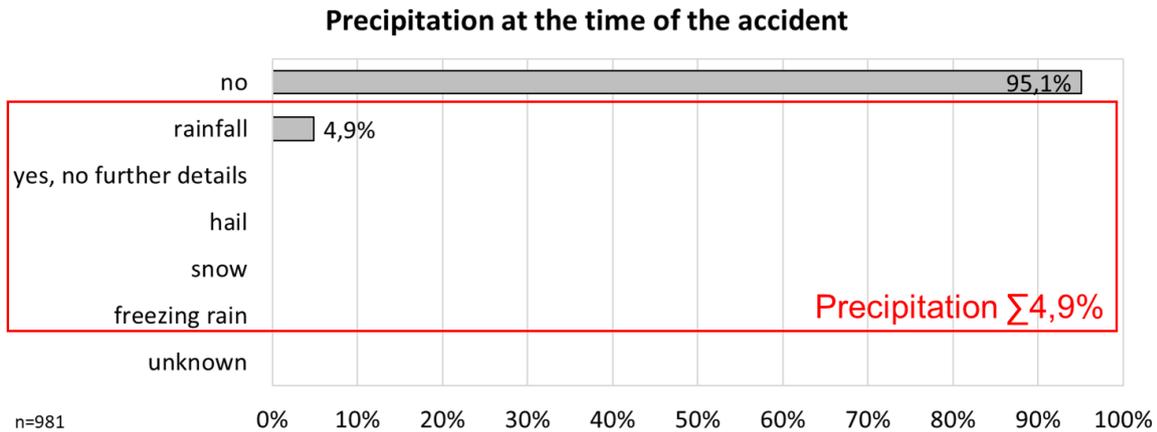


Figure 52: Precipitation (611 & 612)

5.1.15 o) Road condition

Figure 53 and Figure 54 show the road condition at the time of the accident.

At the accident types 601 & 602, most accidents occurred on dry roads. Almost every 11th accident of this use case happened on damp or wet roads (Figure 53).

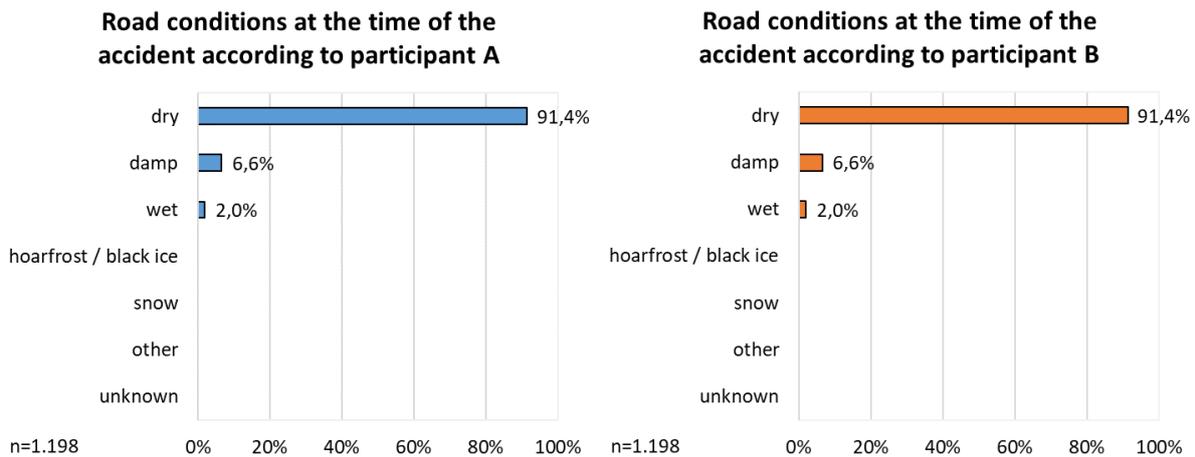
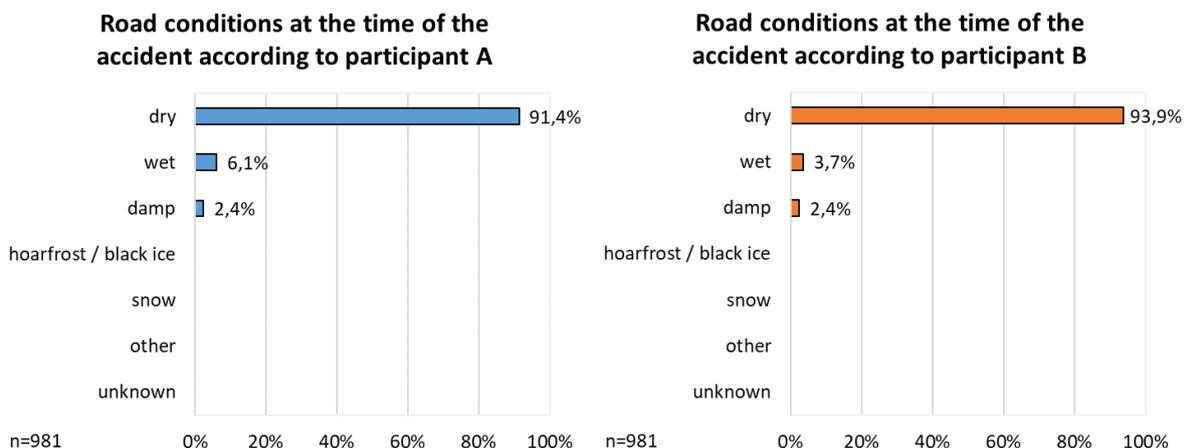


Figure 53: Road condition (601 & 602)

At the accident types 611 & 612, again most accidents occurred on dry roads (Figure 54).



Accident Analysis – Longitudinal Traffic

Figure 54: Road condition (611 & 612)

6. Conclusion

CMC analysed longitudinal traffic accident types 601 & 602 and 611 & 612 in detail based on the GIDAS database. The database provides insights into a great number of aspects of each reported accident; for example, road conditions, speed, visibility of the participants etc. In this analysis, a total of 15 potential influencing factors were investigated and reported, including the ones that eventually did not appear to have an important contribution to the accident.

The longitudinal traffic accident is a conflict between a road user (Participant A) and a road user (Participant B) who is driving in front. From the analysis, an important outcome is that the majority of Participants A who hit the rear end of Participants B are PTW riders (for accident types 601 & 602: 79.0%, for accident types 611 & 612: 75.8%). The main accident causer of the longitudinal traffic accident is basically Participant A. Therefore, the most frequent accident causers are PTW riders among Participant A (for accident types 601 & 602: 71.5% of all accidents, for accident types 611 & 612: 75.8%). There was no view obstruction more than 90% of the cases, but still Participant A (mainly PTWs) hit Participant B (mainly cars/ trucks). Accident causations are not keeping distance between the participants and speeding made by Participant A. This implies that there is a need for technology support to inform or warn Participant A of a possible rear end collision in accordance with distance and relative speed between the own vehicle and the vehicle in front.

Abbreviations

| | |
|-------|---------------------------------|
| CMC | Connected Motorcycle Consortium |
| GIDAS | German In-Depth Accident Study |
| PCM | Pre-Crash-Matrix |
| MID | Maneuver IDentifier |
| PTW | Powered Two-Wheeler |
| TTC | Time To Collision |