

CMC Basic Specification Accident Analysis

- European countries

Advanced analysis of Europe accidents: based on official statistics (CARE, ISTAT, ACI, BAAC), IGLAD, and GIDAS database.

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1. Background and Objectives

To pursue the goal "improving motorcycle rider safety", CMC has studied the most frequent PTW (Powered Two-Wheeler) accident scenarios in the GIDAS (German In-Depth Accident Study) database (Figure 1) and the results are explained in other reports.

To be able to make a more accurate assessment of PTW safety for the whole of Europe, CMC has conducted further accident-based investigations on PTW accidents in European countries (EU and selected countries) with the aim to understand the accident situation and its contributing factors.

In detail, 2 levels of analysis were conducted:

High-Level analyses, based on official statistics:

- Overview of the accident situation in Europe, based on official accident statistics
- Evaluation of PTW accidents and their circumstances in two selected countries (e.g., France, Italy)
- The aim is to use these analyses to provide an initial estimate of the proportion of PTW accidents that can be addressed by connective safety systems.
- Detailed Analyses based on IGLAD Data:
 - Application of the existing accident scenario analyses to a current IG-LAD (Initiative for the Global Harmonisation of Accident Data) dataset to get an overview of the collected road traffic accident scenario.
 - These analyses were conducted based on European countries without Germany.

Figure 1 shows an overview of PTW accidents in Germany and European countries by causation. The upper bar graph shows Germany (based on the GIDAS database) and the lower bar graph shows the European countries ex Germany (based on the IGLAD database).



Figure 1: Accident causation in the PTW scenarios (Germany and European countries)

2. Study structure

The accident analyses of European countries are based on official statistics and the accident databases.

This study uses the following sources:

• High-Level analyses, based on official statistics:

- CARE database (Status: May 2018)
 - CARE: European Community database on road accidents throughout the EU, published by the European Commission
- National Statistics of Italy and France
 - Italy: ISTAT, ACI
 - France: BAAC (ONISR)
- Detailed Analyses, based on IGLAD Data:
 - The 5 most frequent accident types were further analysed for the included European countries, in order to find suitable use cases.

3. Summary of the analysis results

In this chapter, a summary of the analysis results is provided. Detailed analysis results can be found in Chapter 4 and Chapter 5.

3.1 Summary and findings of High-Level analysis, based on official statistics

Main findings from CARE (PTW accidents)

- The share of fatal motorcycle accidents among all PTW accidents in Italy, France and Germany is higher than the European average (Italy: +5%-points, France: + 3%-points, Germany: +2%-points).
- The share of moped fatalities among all PTW accidents in France is higher than the European average (+1.5%-points).
- Most PTW fatalities occur during daylight (lighting condition) and on dry road conditions.

Main findings from National data (PTW accidents)

- The share of fatal accidents among all PTW accidents is almost twice as high in France as it is in Germany/GIDAS.
- Italy has the highest proportion of urban accidents (85%), followed by France (72%) compared to Germany/GIDAS (60%).
- The proportion of "night" accidents in France is more than twice as high as in Germany/GIDAS.
- The proportion of the various road conditions in Germany, France and Italy is almost equal.
- The collision opponents in Germany and Italy are almost the same. There is no available information on collision opponents from France.
- The share of PTW accidents in all road traffic accidents is lowest in Germany compared to Italy and France.
- Differences between the nature of PTW accidents in Europe and in Germany:
 - The proportion of the "vehicles leaving the carriageway" scenario in Italy is significantly lower than in Germany (-12%-points)
 - The proportion of the "pedestrians hit" scenario in Italy is significantly higher than in Germany (+3.5%-points)
 - The proportion of the "head-on collision" scenario in France is almost twice as high as in Germany.

3.2 Summary and findings of the Detailed Analysis, based on IGLAD data

CMC has conducted detailed analysis on PTW accidents in European countries ex Germany based on IGLAD, and compared with that in Germany based on GIDAS.

Main findings from IGLAD and GIDAS (PTW accidents).

- The top 3 accident types are the same in Italy, France and the overall view of Europe (in the mentioned framework). (5.1)
- Accident type 211: There is a small difference in speed, apart from that a good comparison to German data is possible.
- Both the initial speed and the collision speed in European countries are higher than in Germany. (5.2)
- Accident type 202: There are differences in location, apart from that a good comparison to German data is possible.
- The accidents in European countries have a significantly higher share of urban accidents than those in Germany. (5.3)
- Accident type 302: There are small differences in the share of the kind of road users and collision speed, apart from that a good comparison to German is possible.
- Accidents in Germany have a higher share of M1/N1 vehicles (passenger cars / light commercial vehicles) as Participant A than European countries, and European countries have a significantly higher share of M1/N1 vehicles as Participant B than Germany. (5.4)
- Accident type 321: There are minimal differences in the share of the kind of road users (more bicycles are involved in German data) and also regarding collision speed, apart from that a good comparison to German data is possible.
 - The share of bicycles involved in the accidents is higher in Germany than in European countries. (5.5)
 - In European countries, the top 3 contributing factors for Participant A are related to disregarding the traffic regulation. The most frequent contributing factor for Participant B is speed. (5.5)
- Accident types 232 and 682 are characteristic and frequent cases in European countries, but not prominent in Germany. (5.1)
- Therefore, these accident types were not included in the earlier accident analysis reports, and this report is the first time to analyse those. Consequently, the current report includes a detail analysis of the German situation even if the information is not available for European countries.

- Accident type 232: There is a difference in the share of the kind of road users (more PTWs as Participant A and a more of M1/N1 vehicles as Participant B), apart from that a good comparison to German data is possible.
 - Almost all the accidents in Germany and European countries occurred on urban roads. (5.6)
 - Participants A are mostly M1/N1 vehicles and Participants Bare mostly PTWs, both in Germany and European countries. The accidents in European countries have a higher share of PTWs as Participant A and a higher share of M1/N1 vehicles as Participant B compared to the accidents in Germany. (5.6)
 - In Germany, the main accident causer is Participant A in 62.1% of the cases, and Participant B in 37.9% of the cases. If the main accident causer is Participant A, in approximately 78% of the cases these are M1/N1 vehicles. If the main accident causer is Participant B, in approximately 91% of the cases these are PTWs. (5.6) (This information is not available for European Countries.)
 - In Germany, the most frequent used lane type for Participant A is the single lane crossing (37.9%). The second most frequent used lane type for Participant A is the lane for going straight ahead of 2 lane crossing, which means they chose the wrong lane to turn right (17.2%). (5.6) (This information is not available for European Countries.)
 - In Germany, around 83% of the cases had no view obstructions from Participant A and the rest had view obstructions, e.g., unclear window. (5.6) (This information is not available for European Countries.)
 - In both Germany and European countries, the most frequent contributing factor for Participant A is mistake during turning. The most frequent contributing factor for Participant B in Germany is unlawful right-hand overtaking (48.3%). (5.6)

- Accident type 682: There is a difference in the share of the kind of road users (more PTWs as Participant A), apart from that a good comparison to German data is possible.
 - In most cases, the accidents in Germany and European countries occurred on rural roads. (5.7)
 - In European countries, the most frequent accident scene is secondary arterial and the second most is principal arterial. (5.7)
 - In Germany, the share of PTW (56.3%) is higher than M1/N1 vehicles (43.7%), but the share of M1/N1 vehicles and PTWs are relatively close for both Participant A and for Participant B. In European countries, PTWs have a much higher share as Participant A (75.6%) than M1/N1 vehicles (22.0%). (5.7)
 - In Germany, the main accident causer is Participant A in 79.7% of the cases, and Participant B in 20.3% of the cases. Approximately 60% of the participants are PTWs and approximately 40% of the participants are M1/N1 vehicles. (5.7) (This information is not available for European Countries.)
 - In Germany, regarding Participant A, 65.7% of the cases had no view obstructions, and the rest had view obstructions which were structural circumstances in 22.4% of the cases. (5.7) (This information is not available for European Countries.)
 - In Germany, 15.8% of Participants A exceeded the speed limit, especially at speed limits of 50 km/h, and 10.9% of Participant B exceeded the speed limit, especially at speed limits of 80 km/h. In European countries, there are also some exceeding of the speed limit for Participant A (17%) and Participant B (14.6%). This occurred especially at speed limits of 30 km/h, 50 km/h, 70 km and 80 km/h. (5.7)
 - In Germany, the accidents occur frequently when the speed is from around 40 km/h to 80 km/h and radius of the curve is less than 150 meters. (5.7) (This information is not available for European Countries.)
 - The most frequent contributing factor to the accidents is violation against the rule of the road in both Germany and European countries. The second most frequent factor for the participants in Germany and Participant B in European countries is speed (5.7).

4. Analysis results in detail (High-Level analysis)

4.1 Share of PTW accidents and PTW fatalities

Figure 2 shows the distribution of PTW accidents in all road accidents in Germany, Italy and

France. The share of PTW accidents in all road traffic accidents is lowest in Germany compared to Italy and France.

Figure 3 shows PTW fatalities in EU countries, based on CARE data. The percentage shown refers to the total PTW accidents in each country.

The share of PTW fatalities in Italy, France and Germany are higher than the European average. Italy has the highest share of motorcyclist fatalities in Europe, and France has the highest share of moped rider fatalities in Europe which is almost twice as the German moped rider fatalities. The share of motorcyclist fatalities is much higher than the share of moped rider fatalities across the whole of Europe.



Figure 2: Distribution of PTW accidents (Germany, Italy and France)



Figure 3: PTW fatalities among all PTW accidents (Europe, France, Italy and Germany)

Figure 4 shows the severity of injury caused by PTW accidents in Germany and France. The patterns are similar, but it is also observed that the proportion of fatal accidents in France is almost twice as high as in Germany.



Figure 4: PTW accidents by severity of injury (Germany and France)

4.2 Distribution of location

Figure 5 shows the location of PTW fatal accidents in Europe based on the CARE database. PTW fatalities occur most frequently in urban areas (51%) followed by rural areas (47%). Motorcyclist fatalities occur more frequently in rural areas (56%) than in urban areas (38%). Moped rider fatalities occur slightly more frequently in urban areas (51%) than in rural areas (47%). The share of PTW fatalities on motorways is low, but motorcyclist fatalities on motorways are three times higher than those of moped riders.



Figure 5: PTW fatalities by location (Europe)

Figure 6 shows the location of PTW accidents in Germany, France, and Italy. Italy has the highest proportion of urban accidents (85%), followed by France (72%) and Germany (60%).



Figure 6: PTW accidents by location (Germany, France and Italy)

4.3 Kind of road user

Figure 7 and Figure 8 show the type of vehicle in the accidents involving PTWs in Germany, France and Italy. In case of France, data cannot be subdivided into Participants A and B.



Figure 7: Kind of road user (Germany and France)

n=39.7	-39.732 Collision opponent in PTW accidents Italy		Accident Level	n=26.22	¹ Collisio	on opponent in PTW accidents Germany (DESTATIS)		Accident Level	
100% 90% 80% 70% 60% 50% 30% 20% 10% 0%	 PTW, 5.3% Truck, 6.8% 	83.4%	 Other, 1.5% Bicycle, 2.3% Bus, 0.6% 	© Other Bicycle PTW Truck Bus Car	100% 90% 80% 70% 60% 30% 40% 30% 20% 10% 0%	 PTW, 3.2% Truck, 5.7% 	80.8%	 Other, 5.6% Bicycle, 3.9% Bus, 0.7% 	©Other Bicycle PTW Truck Bus Car
	Min. 2 moving vehicles (one of them is a PTW); considered only the first two mentioned vehicles					Exactly	2 participants (one of the	m is a PTW)	

Figure 8: Collision opponent (Italy and Germany)

4.4 Lighting conditions

Figure 9 shows the lighting conditions (day or night) of PTW fatal accidents in Europe based on the CARE database.

Most PTW fatalities occur during daylight.



Figure 9: PTW fatalities by lighting condition (Europe)

Figure 10 shows the lighting conditions of PTW accidents in Germany and France. Most PTW accidents occurs during daylight in both Germany and France. The proportion of "night" accidents in France is more than twice as high as in Germany.



Figure 10: PTW accidents by lighting condition (Germany and France)

4.5 Road conditions

Figure 11 shows the road conditions of PTW fatal accidents in Europe based on the CARE database.

Most PTW fatalities occur on dry roads. The share of moped fatalities on wet roads is 4 times higher than that of motorcycles.



Figure 11: PTW fatalities by road condition (Europe)

Figure 12 shows the road conditions of PTW accidents in Germany, France and Italy. The proportions of the various road conditions in Germany, France and Italy are almost equal.



Figure 12: PTW accidents by road condition (Germany, France, and Italy)

4.6 Type of accidents

Figure 13 to Figure 15 show an overview of scenarios of PTW accidents in Germany, France and Italy. Any corresponding scenarios between them are indicated by a surrounding rectangle. The "Two vehicles -from the side" – scenario (indicated by a broken orange rectangle) is the most frequent one in the 3 countries.

The proportion of the "Vehicles leaving the carriageway" – scenario (the red rectangle) in Italy is significantly lower than in Germany (-12%-points).

The proportion of the "Pedestrians hit" – scenario (the green rectangle) in Italy is significantly higher than in Germany (+3.5%-points).

The proportion of the "Head-On collision" – scenario (the blue rectangle) in France and Italy is higher than in Germany, and the share in France is almost twice as high as in Germany.



Figure 13: Overview of accident scenarios (Germany)



Figure 14: Overview of accident scenarios (France)

Accident Analysis - European countries



Figure 15: Overview of accident scenarios (Italy)

5. Analysis results in detail (Detailed analysis)

In order to find suitable use cases, the 5 most frequent accident types were further analysed over the European countries included in IGLAD together (except Germany).

Notes on the analysis

- German data (GIDAS) include accidents up to 2020
- European data (IGLAD) include accidents up to 2021
- European data (IGLAD) does not contain German data
- European data (IGLAD) countries considered:
 - Austria
 - Czech Republic
 - France
 - Italy
 - Sweden
 - Spain

The information applies to this chapter.

In the following chapters, the characteristics / different natures of the top 5 PTW accident types in European countries are described.

5.1 Overview of accidents in European countries

Figure 16 shows the top 5 PTW accident types of European countries, Italy, and France. 'A' and 'B' in each accident type figure in Figure 16 are road users involved in the accident, 'Participant A' and 'Participant B'.

The top 3 accident types (type 211, 202, and 302) are the same in European countries, Italy, and France. Since these types are also frequent cases in Germany (Figure 17), they were analysed in the Germany database GIDAS and are published as CMC Accidentology reports. Accident types 682 and 232 are also frequent cases in European countries. Since these cases are not frequent cases in Germany however, they have not been analysed in the PTW accident analysis for Germany.



Accident Types - Top 5

Figure 16: Top 5 PTW accident types (European countries, Italy, and France)



Figure 17: Top 5 PTW accident types in each accident type category (Germany)

(Crossing traffic, Left turn, and Lane change)

Figure 18 shows the Engine power of PTWs in European countries and in Germany. The figure shows a significantly higher share of PTWs with a maximum power of 4 kW in European Countries.



Figure 18: Engine power of PTW (European countries and Germany)

Figure 19 shows the location of the PTW accident scene in European countries and Germany. The majority of PTW accidents occurred on urban roads, which account for 65.8% of cases. Accidents which occurred in rural areas account for 34.2% of cases. In the IGLAD data, motorways are included under "rural". The share of urban accidents is higher than in Germany.



Figure 19: Location of the accident (European countries and Germany)

Figure 20 shows the kind of road user that was involved in the PTW accidents in European countries and Germany. In European countries, Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) in 53.2% of the cases and of PTWs in 41.3%. Participant B consists of PTWs in 68.7% of the cases. In European countries, the share of PTW as Participant A is lower and the share of M1/N1 vehicle as Participant A is higher than in Germany.



Figure 20: Kind of road user (European countries)

5.2 Accident type 211

Figure 21 shows the location of the type 211 PTW accident scene. The majority of the accidents in European countries occurred on urban roads which accounts for 66,3%. The type 211 accidents in Germany have a significantly higher share of urban accidents than the type 211 accidents in European countries.



Figure 21: Location of the accident (type 211 in European countries and Germany)

Figure 22 shows the kind of road user that was involved in the type 211 PTW accidents. In most cases, Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and for Participant B, PTWs. This is similar to the German analysis result, but the accidents in European countries have a lower share of M1/N1 vehicles and a higher share of PTWs as Participant A compared to the accidents in Germany.



Figure 22: Kind of road user (type 211 in European countries and Germany)

Figure 23 and Figure 24 show the initial and collision speed of Participants B in European countries and in Germany. Both the initial speed and the collision speed in European countries are higher than Germany, and the Participants B in European countries decelerate in a smaller rate before the collision than in Germany.



Figure 23: Initial speed of Participant B





Figure 24: Collision speed of Participant B (type 211 in European countries and Germany)

5.3 Accident type 202

Figure 25 shows the location of the type 202 PTW accident scene. The majority of accidents in European countries occurred on urban roads which accounts for 82.1%. This is a significantly higher share for urban roads than the average of all PTW accidents in European countries (Figure 19), and than the type 202 accidents in Germany.



Figure 25: Location of the accident (type 202 in European countries and Germany)

Figure 26 shows the accident scene of type 202 accidents. The "collector" accident scene in IGLAD corresponds to "crossing", "junction", and "roundabout" in GIDAS. The share of "collector" is higher in Germany than European countries.



Figure 26: Accident scene (type 202 in European countries and Germany)

Figure 27 shows the kind of road user involved in the type 202 PTW accidents. The majority of Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and most of Participant B consists of PTWs. This is similar to the German analysis result, but the accidents in European countries have a lower share of PTWs as Participant B than the accidents in Germany.



Figure 27: Kind of road user (type 202 in European countries and Germany)

Figure 28 and Figure 29 show the initial and collision speed of Participants B in European countries and in Germany. Both the initial speed and the collision speed of the accidents in Germany are higher than in the European countries. The initial speed and the collision speed of Participants B in European countries is almost the same, which means they did not decelerate before the collision in most cases.



Figure 28: Initial speed of type Participant B (type 202 in European countries and Germany)



Figure 29: Collision speed of Participant B (type 202 in European countries and Germany)

5.4 Accident type 302

Figure 30 shows the kind of road user involved in the type 302 PTW accidents in European countries and Germany. In most cases, Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and in most cases, Participant B consists of PTWs. This is similar to the German analysis result, but the accidents in Germany have a higher share of M1/N1 vehicles as Participant A than the accidents in European countries, and European countries have a significantly higher share of M1/N1 vehicles as Participant B than Germany.



Figure 30: Kind of road user (type 302 in European Countries and Germany)

Figure 31 and Figure 32 show the initial and collision speed of Participants B in European countries and in Germany. The collision speed of the accidents in European countries is higher than in Germany.



Figure 31: Initial speed of Participant B (type 302 in European Countries and Germany)



Figure 32: Collision speed of Participant B (type 302 in European Countries and Germany)

5.5 Accident type 321

Figure 33 shows the kind of road user involved in the type 321 PTW accidents. The majority of Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and most of Participant B consists of PTWs. This is similar to the German analysis result, but the share of bicycles involved in the accidents is higher in Germany than in European countries and the share of PTWs as Participant A is also higher in Germany than in the European countries.



Figure 33: Kind of road user (type 321 in European Countries and Germany)

Figure 34 shows contributing factors to the type 321 accidents in European countries. In European countries, the top 3 contributing factors for Participant A are related to disregarding the traffic regulation. Disregarding of traffic regulation was also one of the most common contributing factors in German PTW accident analyses in GIDAS. The most frequent contributing factor for Participant B is speed.



Figure 34: Contribution factors (type 321 in European Countries)

5.6 Accident type 232

The accident type 232 scenario describes a conflict between two road users, where Participant A is turning right and Participant B is following / overtaking Participant A on its right side, regardless of the number of lanes in one direction. (Figure 35)



Figure 35: Accident type 232

Figure 36 shows the location of the type 232 PTW accident scene. Almost all of these accidents in Germany and European countries occurred on urban roads.



Figure 36: Location of the accident (type 232 in Germany and European countries)

Figure 37 shows the accident scene of type 232 accidents. The "collector" accident scene in IGLAD corresponds to "crossing", "junction", and "roundabout" in GIDAS. In most cases, type 232 accidents occurred on "collector" roads and the share of "collector" is higher in European countries than Germany. In Germany, 13.8% of the accidents occurred at property exits.



Figure 37: Accident scene (type 232 in Germany and European countries)

Figure 38 shows the kind of road user that was involved in the type 232 PTW accidents in Germany and European countries. In most cases, Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and Participant B, of PTWs, both in Germany and European countries. The accidents in European countries have a higher share of PTWs as Participant A and a higher share of M1/N1 vehicles as Participant B compared to the accidents in Germany.



Figure 38: Kind of road user (type 232 in Germany and European countries)

The main accident causer in the accidents in Germany is shown in Figure 39. The main accident causer is Participant A in 62.1% of the cases, and Participant B in 37.9% of the cases. If the main accident causer is Participant A, in approximately 78% of the cases these are M1/N1 vehicles. If the main accident causer is Participant B, in approximately 91% of the cases these are PTWs.



Figure 39: Main accident causer (type 232 in Germany)

Figure 40 shows which lane the participants used when encountering an accident in Germany. The most frequent used lane type for Participant A is the single lane crossing (37.9%). The second most frequent used lane type for Participant A is the lane for going straight ahead of 2 lane crossing, which means they chose the wrong lane to turn right (17.2%). The most frequent and the second most frequent used lane type for Participant B are the same as for Participant A.



Figure 40: Used lane at an accident (type 232 in Germany)

Figure 41 shows the existence of view obstructions and the types of obstruction respectively. Among Participants A, around 83% report no view obstructions while the rest had some view obstructions, e.g., an unclear window.



Figure 41: View obstructions (type 232 in Germany)

Figure 42 shows the share of participants exceeding the applicable speed limit for accident type 232. In Germany, most of the participants do not exceed the speed limit, but a small percentage of the participants exceed the speed limit at speed limits of 10 km/h and 50 km/h. In European countries, almost none of the Participants A and B exceed the speed limit.



Figure 42: Exceeding speed limit (type 232 in Germany and European countries)

Figure 43 and Figure 44 show the initial and collision speed in European countries and in Germany.

The initial speed of Participant A is around 28 km/h at the median and the initial speed of Participant B is around 40 km/h at the median in European countries and in Germany.

The collision speed of Participant A is higher in European countries than in Germany. The collision speed of Participant B is around 30 km/h at the median in European countries and in Germany.



Figure 43: Initial speed of Participants (type 232 in European countries and Germany)



232 (



Figure 44: Collision speed of Participants (type 232 in European countries and Germany)

Figure 45 shows contributing factors to the type 232 accidents in Germany, and Figure 46 shows those in European countries.

In both Germany and European countries, the most frequent contributing factor for Participant A is a mistake during turning (41.4% in Germany).

The most frequent contributing factor for Participant B in Germany is unlawful right-hand overtaking (48.3%). Contributing factors for Participant B in European countries are 'none' in many cases, but there were also mistakes made while making the manoeuvre, excessive speed, violation against the rules, and rain as contributing factors.



Figure 45: Accident causation (type 232 in Germany)

Accident Analysis - European countries



Figure 46: Contribution factors (type 232 in European Countries)

5.7 Accident type 682

The accident type 682 scenario describes a conflict between two road users, where Participant A is traveling along inside of the curve and Participant B is oncoming along outside of the curve, regardless of the number of lanes in one direction. (Figure 47)



Figure 47: Accident type 682

Figure 48 shows the location of the type 682 PTW accident scene. In most cases, the accidents in Germany and European countries occurred on rural roads.



Figure 48: Location of the accident (type 682 in Germany and European countries)

Figure 49 shows the accident scene of type 682 accidents. The figure regarding Germany on the left shows that almost all accidents occurred on a bend in the road. The figure regarding European countries on the right shows that the most frequent accident scene is a secondary arterial and the second most is a principal arterial.



Figure 49 Figure 50: Accident scene (type 682 in Germany and European countries)

Figure 51 shows the kind of road user that was involved in the type 682 PTW accidents. In Germany, the share of PTWs as Participant A (56.3%) is higher than that of M1/N1 vehicles (passenger cars / light commercial vehicles) (43.7%), but the shares of M1/N1 vehicles and PTWs are relatively close for both Participant A and B. In European countries, for Participant A there is a much higher share of PTWs (75.6%) in comparison to M1/N1 vehicles (22.0%).



Figure 51: Kind of road user (type 682 in Germany and European countries)

The main accident causer in the accidents in Germany is shown in Figure 52. The main accident causer is Participant A in 79.7% of the cases, and Participant B in 20.3% of the cases. Approximately 60% of the participants are PTWs and approximately 40% of the participants are M1/N1 vehicles.



Figure 52: Main accident causer (type 682 in Germany)

Figure 53 shows the existence of view obstructions and the types of obstruction respectively in Germany. Regarding Participant A, 65.7% of the cases had no view obstructions, and the rest had view obstructions, which were structural circumstances in 22.4% of the cases. Regarding Participant B, the outcomes are similar.



Figure 53: View obstructions (type 682 in Germany)

Figure 54 shows the share of participants exceeding the applicable speed limit.

In Germany, 15.8% of Participants A exceeded the speed limit, especially at speed limits of 50km/h, and 10.9% of Participants B exceeded the speed limit, especially at speed limits of 80km/h.

In European countries, there was also some exceeding of the speed limit for Participant A (17%) and Participant B (14.6%). This occurred at speed limits of 30km/h, 50km/h, 70km and 80km/h.





Figure 54: Exceeding speed limit (type 682 in Germany and European countries)

Figure 55 shows the relation between the initial speed and the radius of the curve in Germany. The accidents occur frequently when the initial speed is from around 40km/h to 80km/h and the radius of the curve is less than 150m.



Figure 55: Initial speed vs Curve radius (type 682 in Germany)

Figure 56 and Figure 57 show the initial speed and the collision speed in Germany and European countries. In terms of initial speed, there is a tendency to higher speeds in GIDAS. Regarding the collision speed, a good approximation between GIDAS and IGLAD can be seen.



Figure 56: Initial speed of Participants (type 682 in Germany and European countries)



Figure 57: Collision speed of Participants (type 682 in Germany and European countries)

Figure 58 shows contributing factors to the type 682 accidents in Germany, and Figure 59 shows those in European countries.

The most frequent contributing factor for the participants is common in Germany and European countries, which is violation against the rule of the road. The second most frequent factor for the participants in Germany and Participant B in European countries is speed.



Figure 58: Accident causation (type 682 in Germany)



Figure 59: Contribution factors (type 682 in European Countries)

6. Conclusion

For more accurate assessment of PTW safety for the whole of Europe and the future improvement of PTW rider safety with technology, CMC analysed PTW accidents in European countries based on official statistics and IGLAD in-depth data, comparing previously analysed German PTW accident data. Overall, we found that the trends in the German data were also applicable to the whole of Europe. However, a range of interesting differences were discovered.

Main findings from High-Level analysis:

- In EU countries, motorcycle fatality is 15.7% and moped fatality is 2.7% according to the CARE data. Motorcycle fatality is especially high in Italy (22.0%), and moped fatality is especially high in France (4.1%). The percentage refers to total road traffic fatalities.
- In EU countries, 51% of PTW fatalities occur in urban areas and 47% in rural areas according to the CARE data. According to national statistics, Italy has the highest proportion of urban PTW accidents (85%), followed by France (72%) and Germany (60%).
- Most PTW fatalities occur during daylight and on dry roads.
- Differences in accident scenarios between countries:
 - The proportion of the "vehicles leaving the carriageway" scenario in Italy is significantly lower than in Germany (-12%-points)
 - The proportion of the "pedestrians hit" scenario in Italy is significantly higher than in Germany (+3.5%-points)
 - The proportion of the "head-on collision" scenario in France is almost twice as high as in Germany.

Main findings from Detailed analysis:

- The top 5 PTW accident types in European countries (except Germany) were analysed to find out if they have different characteristics or a different nature compared to those in Germany. The top 3 accident types in Europe are type 211, 202, and 302, which are also the top 3 accident types in Italy and France, and which are also frequent accident types in Germany. Accident type 232 and 682 are frequent cases in European countries but not in Germany. (5.1)
- The top 3 accident types tend to have a similar share compared to Germany, but there are some significantly different points:
 - At accident type 211, the accidents in European countries have a higher share of rural accidents than in Germany. (5.2)
 - At accident type 202, the accidents in European countries have a significantly higher share of urban accidents than in Germany. (5.3)
 - At accident type 321, the share of bicycles involved in the accidents is higher in Germany than in European countries. (5.5)
 - Overall, there is good comparability of the investigated accident types with the GIDAS data.
- As to the nature of accident type 232 and different points between Germany and European countries:
 - Almost all of the accidents in Germany and European countries occurred on urban roads. (5.6)
 - Participant A consists of M1/N1 vehicles (passenger cars / light commercial vehicles) and Participant B consists of PTWs, both in Germany and European countries. The

accidents in European countries have a higher share of PTWs as Participant A and a higher share of M1/N vehicles as Participant B compared to the accidents in Germany. (5.6)

- In both Germany and European countries, the most frequent contributing factor for Participant A is a mistake during turning. The most frequent contributing factor for Participant B in Germany is unlawful right-hand overtaking (48.3%). (5.6)
- Some information about the nature of the accident type 232 is available in Germany, but not in European countries. This information is summarized in chapter 3 (3.2).
- As to the nature of accident type 682 and different points between Germany and European countries:
 - In most cases, the accidents in Germany and European countries occurred on rural roads. (5.7)
 - In European countries, the most frequent accident scene is a secondary arterial and the second most frequent is a principal arterial. (5.7)
 - In Germany, the share of PTWs as Participant A (56.3%) is higher than M1/N1 vehicles (43.7%), but the share of M1/N1 vehicles and PTWs are relatively close for both Participant A and for Participant B. In European countries, PTWs have a much higher share as Participant A (75.6%) than M1/N1 vehicles (22.0%). (5.7)
 - In Germany, 15.8% of Participants A exceeded the speed limit, especially at speed limits of 50 km/h, and 10.9% of Participants B exceeded the speed limit, especially at speed limits of 80 km/h. In European countries, there is also some exceeding of the speed limit for Participant A (17%) and Participant B (14.6%), which occurs especially at speed limits of 30 km/h, 50km/h, 70 km/h and 80 km/h. (5.7)
 - The most frequent contributing factor to the accidents is violation against the rule of the road, both in Germany and European countries. The second most frequent factor for the participants in Germany and for Participant B in European countries is speed (5.7)
 - Some information about the nature of the accident type 682 is available in Germany, but not in European countries. This information is summarized in chapter 3 (3.2).

Abbreviations

- ACI Automobile Club d'Italia (Automobile Club of Italy)
- BAAC Bulletins d'Analyse des Accidents Corporels (Personal Injury Analysis Bulletins)
- CARE Community database on Accidents on the Roads in Europe
- CMC Connected Motorcycle Consortium
- GIDAS German In-Depth Accident Study
- IGLAD Initiative for the Global Harmonisation of Accident Data
- ISTAT Istituto nazionale di statistica (National Institute of Statistics)
- ONISR Observatoire national interministertériel de la sécurité routière (The French Road Safety Observatory)
- PTW Powered Two-Wheeler
- RM1 Research Module 1