The effectiveness of Cornering ABS on motorcycles in reducing real-life crashes, compared to regular ABS

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Abstract

Over the past decade, several jurisdictions across the world have mandated the fitment of Antilock Brakes (ABS) on new motorcycles. During the same period Cornering ABS, i.e. a further development of ABS, was introduced by adding inertial sensors, thus making it possible to dynamically adjust braking forces on the wheels based on the cornering angle and motorcycle speed. While a few counterfactual analyses have investigated the potential benefits of Cornering ABS, for instance based on in-depth studies of motorcycle crashes, there is still a lack of evaluations of the effectiveness of Cornering ABS in real-life situations. Therefore, the present study set out to evaluate the effectiveness of Cornering ABS in reducing real-life crashes, compared to regular ABS.

The analysis was based on the Swedish National Crash Database (STRADA). All police-reported crashes involving an injured motorcycle driver during the period 2015-2023 were extracted. The fitment of Cornering ABS, regular ABS and other safety technologies was coded separately. The calculations were based on an induced exposure approach, in which 220 crashes involving motorcycle models with Cornering ABS were compared to 661 crashes with similar models with regular ABS. The comparison was based on a number of criteria such as engine displacement, category and age of the motorcycle. Previous research has found that head-on crashes were the least ABS-affected crash type and was therefore used as the non-sensitive crash type in these calculations. This finding was also verified in the present dataset.

The results showed that all police-reported injury crashes were reduced with Cornering ABS by 35%, with a 95% lower confidence limit of 10%, compared to regular ABS. Similar results were found for all severe and fatal crashes (44% ± 31%). While the reduction of all single-vehicle crashes was of similar magnitude as the overall crash reduction, it was found that severe and fatal single-vehicle crashes in curves were reduced by 70% ± 31%. No statistically significant reduction of rear-end crashes was found.

Overall, the present results are of similar magnitude as previously reported in other studies. Nonetheless, it is of crucial importance to keep evaluating new vehicle technologies as soon as possible. In the present case, evaluating the real-life benefits of Cornering ABS took approximately 10 years from its first introduction. Therefore, it is recommended that future research should explore the possibility of combining crash data from different jurisdictions to minimize the time needed for real-life evaluation.

Introduction

Motorcycle Antilock Braking Systems (ABS), also known as Anti-lock Brakes, were introduced in the late 1980s in order to improve stability by maintaining wheel rotation during hard braking. While ABS have been shown to generally provide shorter stopping distances (Green 2006) for both experienced and novice riders (Vavryn et al. 2004), ABS can also prevent the motorcyclist from falling to the ground during hard braking (Roll et al. 2009; Rizzi et al. 2016).

Several studies have evaluated the real-life benefits of Motorcycle ABS. Among others, Rizzi et al. (2015) reported a reduction of police-reported injury crashes ranging from 24% in Italy to 29% in Spain, and 34% in Sweden. The reductions in severe and fatal crashes with ABS were even greater, at 34% in Spain and 42% in Sweden. By using a similar approach, Fildes et al. (2015) reported that ABS reduced injury crashes in Australia by 33%. In more recent years, Teoh (2022) updated previous studies (Teoh 2011) and reported a 22% reduction in motorcycle driver fatal crash involvements per 10000 registered vehicle years in the US. Based on Swiss insurance data, Sulzberger et al. (2023) found that motorcycles equipped with standard ABS were associated with an 18% reduction in claim frequency compared to motorcycles without ABS.

Over the past decade, several jurisdictions across the world have mandated the fitment of ABS on new motorcycles above a certain threshold - most often based on engine displacement. In the European Union, in particular, all new motorcycles with engine displacement above 125cc have mandatory ABS since 2017 (EU 2013). During the same period Cornering ABS, ie a further development of ABS, was introduced by adding inertial sensors (Lich et al. 2016), thus making it possible to dynamically adjust braking forces on the wheels based on the cornering angle and motorcycle speed (Ait Moula et al. 2024). This technology aims at preventing the motorcycle from straightening out during cornering, addressing a common limitation of conventional ABS braking systems (Ait Moula et al. 2024). The first motorcycle model with Cornering ABS was the 2014 KTM 1190 Adventure, which was fitted with the Bosch MSC (Motorcycle Stability Control) thus including other technologies such as Traction Control, Wheelie Control and Combined Braking System (CBS) (Lich et al. 2016). Since then, most of the major motorcycle manufacturers have fitted Cornering ABS on at least a few of their models in the European market.

At the present stage a few studies have investigated the potential benefits of Cornering ABS. Based on detailed crash reconstruction from Germany, Lich et. Al (2016) concluded that two-channel ABS could prevent 26% of all injury crashes with motorcycles in Germany. It was also estimated that the MSC technology had the potential of avoiding additional 5% of injury crashes. A later study conducted in Austria with an integrated experimental and statistical methods estimated that Cornering ABS may have a positive influence on 9% of all motorcycle injury crashes (Sevarin et al. 2018). Similar results were reported by Ait Moula et al. (2024). Based on French national data, regular ABS was estimated to potentially reduce crashes by 39% with an additional 9% reduction with Cornering ABS. Another study by the same authors, based on detailed crash reconstructions from France, concluded that MSC could avoid or mitigate up to 77% of motorcycle crashes in corners (Ait Moula et al. 2022).

While the mentioned studies indicate that Cornering ABS could add additional benefits to regular ABS, to the best of the authors' knowledge there is still a lack of evaluations of the effectiveness of Cornering ABS in real-life situations. Therefore, the objective of the present study was to evaluate the effectiveness of Cornering ABS in reducing real-life crashes, compared to regular ABS.

Material

The present study used national police records from Sweden. The Swedish Transport Accident Data Acquisition (STRADA) is managed by the Swedish Transport Agency and includes police records that can be merged with hospital data. In Sweden, crashes involving motor-vehicles on public roads causing at least one injured person are recorded by the police. Four injury levels (fatal, serious, slight, and uninjured) are also assigned by the officer attending the crash scene.

All police-reported crashes involving an injured motorcycle driver during the period 2015-2023 were extracted from STRADA. While some vehicle data are included in STRADA, the fitment of vehicle safety technologies is not. Therefore, the National Moped and Motorcycle Trade Association (McRF) was contacted to assist with detailed information of makes and models fitted with Cornering ABS. This process, alongside with internet searches, provided a fitment dataset that was merged with the police records from STRADA.

Method

The calculations were based on a case-control approach, in which motorcycle models with Cornering ABS (case) were compared to similar models with regular ABS (control). Crash data involving Cornering ABS were available for the following motorcycle categories: dual purpose, standard, sport touring, supersport and touring. Because the number of crashes involving the same models, with Cornering ABS and regular ABS, was too small to compare directly, the control motorcycles were selected from the same categories. Further criteria were set to match the control ABS motorcycles to the case ones fitted with Cornering ABS. Two ABS groups were created, as described below, where the ABS group 1 was intended as primary control group and the ABS group 2 as a supplement to check at what degree the overall results could vary.

- ABS group 1: at least 650cc engine displacement, less than 8 years old motorcycle at the time of the crash

- ABS group 2: at least 650cc engine displacement, model year 2014 – 2023

The threshold for engine displacement was set due to the very limited number of available cases involving motorcycles with Cornering ABS below 650cc. This process resulted in more than 100 motorcycle models being included in the analysis - a detailed list of make/models can be found in Appendix. Table 1 below gives an overview of the material used for analysis. Overall, 220 injury crashes with Cornering ABS were compared to 661 and 531 injury crashes with regular ABS (group 1 and 2, respectively). Single-vehicle crashes accounted for approximately 50% of the included dataset. While police reported crash data are generally known to suffer from a number of data quality problems, it was assumed that this limitation would equally affect both the case and control groups and was therefore not expected to affect this analysis.

Table 1. Overview of the analyzed dataset for the period 2015-2023.

	ABS group 1	**ABS group 2**	**Cornering ABS**
n injured riders	661	531	220
n severely or fatally injured riders	192	150	79
% single-vehicle injury crashes	51 %	51 %	50 %
% dual purpose	19 %	16 %	45 %
% sport touring	7 %	6 %	9 %
% standard	64 %	71 %	33 %
% supersport	7 %	5 %	11 %
% touring	3 %	2 %	2%
% Traction Control standard or optional	62 %	63 %	100 %
Mean vehicle age (years)	3,4	3,2	2,0
Mean model year	2016	2017	2019
Model year range	2008 − 2023	2014 − 2023	2014 − 2023
Mean rider age	40,3	39,3	43,6
Rider age range	18 − 76	18 − 76	20 − 78
% dry road conditions	86 %	87 %	85 %
% rural roads	57 %	59 %	72 %
% 70 km/h speed area or above	49 %	52 %	61 %

The statistical analysis was performed with an induced exposure approach. This method can be used when true exposure is not available and is sometimes referred to as an indirect method, because the exposure is derived from the actual crash data (see for example Evans 1998; Lie et al. 2006; Strandroth et al. 2012; Cicchino 2022). Here, the key point is to identify at least one crash type or situation in which the treatment under consideration can be reasonably assumed (or known) not to be effective. Then, the relation between motorcycles with and without the said treatment in that non-sensitive situation would be considered as the true exposure relation, see Eq. (1) below.

$$R = \frac{A_{Cornering\ ABS}}{N_{Cornering\ ABS}} \div \frac{A_{ABS}}{N_{ABS}} \qquad \text{(Eq. 1)}$$

$A_{Cornering\ ABS}$ = number of injury crashes *sensitive* to Cornering ABS, involving motorcycles with Cornering ABS

A_{ABS} = number of injury crashes *sensitive* to Cornering ABS, involving motorcycles with ABS

$N_{Cornering\ ABS}$ = number of injury crashes *non-sensitive* to Cornering ABS, involving motorcycles with Cornering ABS

N_{ABS} = number of injury crashes *non-sensitive* to Cornering ABS, involving motorcycles with ABS

The effectiveness in reducing police-reported injury crashes in relation to non-sensitive crashes was calculated as follows:

$$E_s = 100 \times (1 - R)\% \qquad \text{(Eq. 2)}$$

The standard deviation of the effectiveness was calculated on the basis of a simplified odds ratio variance, see below (Evans 1998; Lie et al. 2006; Strandroth et al. 2012). This method gives symmetric confidence limits but the variance estimate is conservative.

$$Sd\ (R) = \sqrt{\sum_{i=1}^{4} \frac{1}{n_i}} \qquad (\text{Eq. } 3)$$

Where n is the number of crashes of each type. The 95% confidence limits are given in Eq. (5-6).

$$\Delta E_s = 100 \times R \times Sd\ (R) \times 1{,}96 \qquad (\text{Eq. } 4)$$

$$E_{s\ LOWER} = E_s - \Delta E_s \qquad (\text{Eq. } 5)$$

$$E_{s\ UPPER} = E_s + \Delta E_s \qquad (\text{Eq. } 6)$$

The effectiveness in reducing all police-reported crashes and the 95% confidence limits can therefore be calculated as follows (Evans 1998; Lie et al. 2006; Strandroth et al. 2012):

$$E = E_s \times \frac{A_{Cornering\ ABS} + A_{ABS}}{N_{Cornering\ ABS} + N_{ABS} + A_{Cornering\ ABS} + A_{ABS}} \qquad (\text{Eq. } 7)$$

$$\Delta E = \Delta E_s \times \frac{A_{Cornering\ ABS} + A_{ABS}}{N_{Cornering\ ABS} + N_{ABS} + A_{Cornering\ ABS} + A_{ABS}} \qquad (\text{Eq. } 8)$$

$$E_{LOWER} = E - \Delta E \qquad (\text{Eq. } 9)$$

$$E_{UPPER} = E + \Delta E \qquad (\text{Eq. } 10)$$

A crucial step in the analysis was to determine which crash type is least sensitive to Cornering ABS. A previous case-by-case analysis of 164 in-depth studies of motorcycle fatal crashes in Sweden has shown that head-on crashes were least affected by ABS (Rizzi et al. 2009). It was therefore assumed that head-on crashes would be non-sensitive to Cornering ABS too. Further analysis of the distribution of the share of Cornering ABS per crash type was also made to verify this, because motorcycles fitted with Cornering ABS would logically be overrepresented in a non-sensitive crash type, compared to the whole population of crashes with Cornering ABS (Rizzi et al. 2015).

Further analysis was made within the case and control groups to check the presence of confounding factors, i.e. to ensure that case and controls came from comparable crash populations. This was done by analyzing the variation of the sensitive/non-sensitive ratios (see Eq. 1) for a number of factors that could possibly confound the results (see Appendix). The effectiveness calculations were then performed according to Eq. (1-10) by comparing the ABS group 1 and 2 with Cornering ABS, respectively.

Single-vehicle crashes in curves were identified by free-text searches (“kurva” in Swedish) in the description of the crash provided by the police officer attending the scene, which is included in STRADA. This was due to the fact that crashes in curves are not specifically coded in STRADA.

Results

The analysis showed that the crash type with the highest involvement of motorcycles with Cornering ABS in the present dataset was head-on, ranging from 34% to 50%, which supported the findings of a previous study (Rizzi et al. 2009). Tables 2 and 3 below give also an overview of the numbers used in the calculations.

Table 2. Number of injury crashes per crash type used in the calculations.

Crash type - injury crashes	**ABS group 1**	**ABS group 2**	**Cornering ABS**	**Share of Cornering ABS**	
Intersection	129	100	41	24 %	29 %
Pedestrians or cyclists	11	10	1	8 %	9 %
Head-on	**58**	**47**	**30**	**34 %**	**39 %**
Single-vehicle in curves	124	97	40	24 %	29 %
Single-vehicle - others	211	176	71	25 %	29 %
Rear-end	49	40	17	26 %	30 %
Wild life	31	25	9	23 %	26 %
Others	48	36	11	19 %	23 %
Total	661	531	220	25 %	29 %

Table 3. Number of severe and fatal crashes per crash type used in the calculations.

Crash type - severe and fatal crashes	**ABS group 1**	**ABS group 2**	**Cornering ABS**	**Share of Cornering ABS**	
Intersection	35	29	15	30 %	34 %
Pedestrians or cyclists	4	3		0 %	0 %
Head-on	**20**	**15**	**15**	**43 %**	**50 %**
Single-vehicle in curves	35	27	8	19 %	23 %
Single-vehicle - others	66	49	28	30 %	36 %
Rear-end	15	14	7	32 %	33 %
Wild life	6	4	1	14 %	20 %
Others	11	9	5	31 %	36 %
Total	192	150	79	29 %	34 %

The induced exposure analysis showed no substantial variations from the overall trends. In particular, the fitment of Traction Control or Combined Braking System was not found to influence the sensitive/non-sensitive ratio, see Appendix.

The results of the main analysis are presented in Tables 4 and 5, showing the calculated reductions compared to regular ABS. It was found that all police-reported injury crashes were reduced with Cornering ABS by 35%, with a 95% lower confidence limit of 10%. Similar results were found for all severe and fatal crashes (44% ± 31%). While the reduction of all single-vehicle crashes was of similar magnitude as the overall crash reduction, it was found that severe and fatal single-vehicle crashes in curves were reduced by 70% ± 31%. No statistically significant reduction of rear-end crashes was found.

Finally, the results based on supplementary ABS group 2 were in line with the main results based on the ABS group 1, see Table 5.

Table 4. Reduction of crashes with Cornering ABS, compared to ABS group 1.

	Injury crashes		**Fatal and serious crashes**	
	E	ΔE	E	ΔE
All crash types	35 %	26 %	44 %	31 %
All single-vehicle	36 %	31 %	52 %	37 %
Single-vehicle in curves	38 %	35 %	70 %	31 %
Rear-end	*33 %*	*47 %*	*38 %*	*70 %*

Table 5. Reduction of crashes with Cornering ABS, compared to ABS group 2.

	Injury crashes		**Fatal and serious crashes**	
	E	ΔE	E	ΔE
All crash types	35 %	27 %	46 %	32 %
All single-vehicle	36 %	32 %	53 %	39 %
Single-vehicle in curves	35 %	38 %	70 %	32 %
Rear-end	*33 %*	*49 %*	*50 %*	*58 %*

Discussion

The present study analyzed Swedish police-reported injury crashes to evaluate the real-life effectiveness of Cornering ABS on motorcycles. The results indicated a statistically significant 35% reduction of all crash types, compared to regular ABS, with a 95% lower confidence limit of 10%. To the best of the authors' knowledge, this was the first attempt to calculate the real-life effectiveness of Cornering ABS which means that it may be difficult to directly compare the present results with previous research. However, the results presented in Lich et al. (2016), Sevarin et al. 2018 and Ait-Moula et al. (2024) support the present findings, ie Cornering ABS provide additional road safety benefits to regular ABS. It should be also noted that the reductions reported in the studies mentioned above were based on the whole crash population, ie not specifically compared to regular ABS, which means that in a Cornering ABS vs regular ABS comparison the percentual reductions would be somewhat higher. For instance, Ait-Moula et al. (2024) reported that regular ABS and Cornering ABS could reduce crashes by 39% and 9%, respectively, compared to no ABS at all. Based on these results, it can be calculated that Cornering ABS would improve the baseline benefits of regular ABS by 9/39=23%.

Also, it is well understood that crash statistics in different countries may differ, even within Europe, which means that different results do not necessarily need to be directly comparable with each other. For instance, single-vehicle crashes accounted for 50% of the present dataset, whereas loss-of-control crashes accounted for 43% and 15% of the material used in Lich et al. (2016) and Ait-Moula et al. (2024), respectively. While it could be expected that different shares of single-vehicle crashes might lead to different results, it can be concluded that the present results are of similar magnitude as previously reported by Lich et al. (2016), Sevarin et al. (2018) and Ait-Moula et al. (2024). In particular, the reduction of severe and fatal single-vehicle crashes in curves seems reasonable, considering the functionality of Cornering ABS, and is well in line with the findings reported by Ait-Moula et al. (2022). The fact that no statistically significant reduction of rear-end crashes was found seems reasonable too, as Cornering ABS would not be expected to influence to any large degree those crashes in comparison to regular ABS.

Nonetheless, this study was based on a number of assumptions and limitations that need to be discussed. First of all, the calculated reduction of injury crashes was based on an induced exposure approach. The basic idea with this method is to derive the exposure from the crash data themselves and to calculate the number of police records with Cornering ABS that should be included in these data, if Cornering ABS had no effect at all. In other words, this may be considered as calculating the "missing crashes" in the analyzed dataset. It should be clear, however, that a certain reduction in police reported crashes does not necessarily mean that no crashes had occurred at all. This issue may be of particular relevance in single-vehicle crashes, ie minor single-vehicle crashes could have occurred without being reported to the police.

The most critical assumption in the present study was to determine the non-sensitive crash type. Though the main method for selecting non-sensitive crashes is a priori analysis of in-depth studies (Rizzi et al. 2009), the distributions of crash types also confirmed that head-on crashes were the least sensitive crash type in the analyzed material. Here, it could be argued that some single-vehicle crashes, particularly those occurring in right-hand curves, may have the same character of head-on crashes, ie the only major difference being that another vehicle happened to be in the oncoming lane. In other words, it could be hypothesized that some of the head-on crashes included in the present dataset could be in fact sensitive to Cornering ABS. While this could definitely be the case, it is important to point out that including some potentially sensitive crashes among the non-sensitive ones would give conservative results (see Eq 1). Nonetheless, the fact that crashes in curves could be only detected through free-text searches is a limitation of the present study. Further research based on STRADA should address this issue by merging crash data with the national road database to address this issue.

A further limitation was that the case and control groups were not based on exactly the same motorcycle models with Cornering ABS and regular ABS, respectively. This was due to the limited number of crashes involving the same models with both technologies, see Appendix. Instead, the analysis was based on make/models that were believed to be similar with respect to vehicle characteristics and user groups. Possible confounding factors were analyzed by performing simple calculations to verify that the case and control groups came from similar crash populations in terms of rider and vehicle age, types of roads etc. Also, the potential fitment of Traction Control or Combined Braking Systems was not found to influence the present results (see Appendix). Nonetheless, it is important to acknowledge that as long as Cornering ABS is not standard equipment in all motorcycles on the roads, it could be argued that motorcyclists choosing such technology are probably more concerned about their safety in the first place, which could naturally lead to a lower crash involvement (i.e. selective recruitment). If crash rates are calculated based on real exposure (i.e. number of crashes divided by number of registered vehicle, or vehicle mileage) it is essential to control for possible confounders, as done in Teoh (2022). However, adopting an induced exposure approach would normally address this issue, as the result is given by the relative differences within the case and control crash populations. Basically, if riders with Cornering ABS were more safety-concerned than those without it, this would be reflected in their involvement in non-sensitive crash types too.

Finally, it should be noted that any behavioral adaptation, if at all present, would intrinsically be present in real-life crash data and included in the overall results. This is the reason why it is of crucial importance to keep evaluating new vehicle technologies as soon as possible. In the present case, evaluating the real-life benefits of Cornering ABS took approximately 10 years from its first introduction. Therefore, it is recommended that future research should explore the possibility of combining crash data from different jurisdictions to minimize the time needed for real-life evaluation. For instance, the approach used in a Euro NCAP consortium to evaluate low-speed Autonomous Emergency Braking on passenger cars seems promising and should be explored further (Van Ratingen et al. 2015).

Conclusions

- Based on Swedish crash data, Cornering ABS on motorcycles was found to reduce police-reported injury crashes by 35% ± 25%, compared to regular ABS
- Similar results were found for all severe and fatal crashes (44% ± 31%)
- The present results are of similar magnitude as previously reported in other studies
- Further evaluations based on real-life crash data should be performed, for instance with the approach used in Van Ratingen et al. (2015)
- Motorcycle manufacturers should accelerate the implementation of Cornering ABS on a wider range of motorcycle models

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Appendix

	ABS group 1			Cornering ABS		
Engine displacement (cc)	n	%	A / N	n	%	A / N
650 − 900	329	50 %	11,7	38	17 %	10,7
900 − 1200	288	44 %	9,3	105	48 %	4,5
≥ 1200	44	7 %	10,0	77	35 %	8,6
kW / kg ratio						
≤ 0,33	250	38 %	12,9	14	6 %	-
0,34 − 0,50	313	47 %	8,2	135	61 %	6,9
≥ 0,51	98	15 %	15,3	71	32 %	4,5
Category						
Dual purpose	128	19 %	10,6	98	45 %	8,8
Sport touring	49	7 %	23,5	19	9 %	8,5
Standard	422	64 %	9,6	73	33 %	6,3
Supersport	45	7 %	14,0	25	11 %	3,2
Touring	17	3 %	7,5	5	2 %	1,5
Motorcycle age (years)						
< 1	42	6 %	20,0	28	13 %	13,0
1 − 2	220	33 %	7,8	128	58 %	7,0
3 − 4	185	28 %	14,4	50	23 %	6,1
5 − 7	214	32 %	10,3	14	6 %	1,8
Traction Control						
Not available	254	38 %	11,1	0	0 %	-
Standard or optional	407	62 %	10,0	220	100 %	6,3
Combined Braking System						
Not available	535	81 %	10,6	0	0 %	-
Standard or optional	119	18 %	10,9	220	100 %	6,3
Unknown	7	1 %	-	0	0 %	-
Speed area (km/h)						
< 50	84	13 %	8,3	18	8 %	2,6
50 − 60	143	22 %	16,9	39	18 %	8,8
70	232	35 %	7,9	111	50 %	5,5
80 − 90	72	11 %	13,4	18	8 %	8,0
≥ 100	23	3 %	4,8	5	2 %	-
Unknown	107	16 %	16,8	29	13 %	13,5
Road environment						
Rural	377	57 %	10,4	159	72 %	6,2
Urban	238	36 %	10,9	50	23 %	5,3
Unknown	46	7 %	8,2	11	5 %	-
Road conditions						
Dry	568	86 %	10,1	187	85 %	5,4
Wet	53	8 %	16,7	18	8 %	17,0
Unknown	40	6 %	9,0	15	7 %	-
Road type						
2+1	15	2 %	14,0	6	3 %	2,0
Freeway	44	7 %	6,3	9	4 %	-
Undivided road	344	52 %	10,9	140	64 %	5,4
Unknown	258	39 %	10,7	65	30 %	9,8
Rider age						
18 − 19	10	2 %	-		0 %	-
20 − 24	63	10 %	9,5	7	3 %	-
25 − 34	207	31 %	12,8	58	26 %	6,3
35 − 44	124	19 %	10,3	50	23 %	5,3
45 − 54	145	22 %	7,1	54	25 %	8,0
55 − 64	75	11 %	14,0	38	17 %	8,5
65 − 74	34	5 %	10,3	9	4 %	3,5
≥ 75	2	0 %	-	2	1 %	-
Gender						
Woman	51	8 %	50,0	7	3 %	6,0
Man	609	92 %	9,7	213	97 %	6,3
Total	**661**	**100 %**	**10,4**	**220**	**100 %**	**6,3**

Make and model	ABS group 1	Cornering ABS
Aprilia Dorsoduro 1200	3	
Aprilia RSV4	3	1
Aprilia Shiver 750	1	
Aprilia Tuono V4 1100	7	17
BMW F 700 GS	6	
BMW F 800 GS	17	
BMW F 800 GT	2	
BMW F 800 R	9	
BMW F 800 ST	3	
BMW K 1300 GT	2	
BMW K 1300 S	2	
BMW K 1600 GT	6	2
BMW R 1200 GS	29	
BMW R 1200 R	6	
BMW R 1200 RS	3	
BMW R 1200 RT	4	
BMW R 1250 GS		31
BMW R 1250 R		1
BMW R 1250 RS		1
BMW R 1250 RT		2
BMW R nine T	7	
BMW S 1000 R	8	1
BMW S 1000 RR	16	2
BMW S 1000 XR		3
Ducati Diavel 1200	2	
Ducati Hypermotard 821/939	4	
Ducati Hypermotard 950		5
Ducati Monster 1100	1	
Ducati Monster 796/803/821	7	
Ducati Monster 937		4
Ducati Multistrada 1200/1260	3	6
Ducati Multistrada 950		2
Ducati Multistrada V4		3
Ducati Panigale 899	3	
Ducati Panigale V2/V4		4
Ducati Scrambler 1100		2
Ducati Scrambler 800	6	
Ducati Streetfighter 848	3	
Ducati Streetfighter V2/V4		5
Ducati Supersport 950	5	3
Honda Africa Twin 1000	13	5
Honda CB 1000 R	19	
Honda CB 1100 EX/RS	1	
Honda CBR 1000 RR	2	
Honda Goldwing 1800	2	
Honda NC 750 SD/XA/XD	10	
Honda ST 1300	2	
Honda Varadero 1000	1	
Honda VFR 1200	6	
Honda VFR 800	2	
Indian FTR 1200 S		1
Kawasaki GTR 1400	2	
Kawasaki H2	1	1
Kawasaki H2 SX		2
Kawasaki Ninja 1000 SX		2
Kawasaki Versys 1000	3	3
Kawasaki Z 1000	20	
Kawasaki Z 1000 SX	6	4
Kawasaki Z 750	8	
Kawasaki Z 800	26	
Kawasaki Z 900	44	
Kawasaki Z H2		2
Kawasaki ZZR 1400	4	
KTM 1050 Adventure	1	
KTM 1090 Adventure	5	
KTM 1190 Adventure		13
KTM 1290 Superadventure		20
KTM 1290 Superduke	8	10
KTM 1290 Superduke GT		6
KTM 790 Adventure		3
KTM 790 Duke		6
KTM 890 Adventure		6
KTM 890 Duke		3
Moto Guzzi MGX-21	1	
Moto Guzzi V85 TT	1	
Suzuki GSF 1250	3	
Suzuki GSR 750	6	
Suzuki GSX-R 1000		3
Suzuki GSX-R 1300	7	
Suzuki GSX-S 1000	17	
Suzuki GSX-S 750	11	
Triumph Bobber 1200 / T120	7	
Triumph Speed Triple 1200 RS		1
Triumph Speed Twin 1200	1	
Triumph Street Scrambler 900	1	
Triumph Street Triple 765 RS	8	
Triumph Street Twin 900	7	
Triumph Thruxton 1200	2	
Triumph Tiger 1050	1	
Triumph Tiger 1200	7	4
Triumph Tiger 800	16	
Triumph Tiger 900		2
Yamaha FJR 1300	5	
Yamaha FZ8-S	5	
Yamaha MT-07	80	
Yamaha MT-09	53	17
Yamaha MT-10	23	2
Yamaha R1		8
Yamaha TDM 900	1	
Yamaha Tenere 700	8	
Yamaha Tracer 700	6	
Yamaha Tracer 9 GT		1
Yamaha Tracer 900 GT	8	
Yamaha XSR 700	4	
Yamaha XSR 900	11	
Yamaha XT 1200 Supertenere	7	