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ASSESSING MOTORCYCLE CRASHES IN THE EU: DATA, TECHNICAL FAILURES AND SAFETY OUTCOMES





PURPOSE

This document aims to provide a rational background to assess the importance of including motorcycles within the scope of periodical inspection at the European Union level, by referring to available studies, data, and research works.

MOTORCYCLISTS HAVE A DISPROPORTIONATE FATALITY SHARE

In 2021, the European Region recorded the lowest number of road traffic fatalities, with 62,670 deaths—about 5% of the global total. Although motorcyclists and other riders of powered two- and three-wheelers account for 30% of all road traffic deaths globally, they represent a much smaller share in the European Region. Because fewer of these vehicles are in use there, they make up only 12% of regional traffic fatalities, or 7,520 deaths (WHO, 2023).

We further note that motorcyclists (including mopeds) account for a disproportionately high share of road deaths relative to their road use. In 2022, there were 3,361 motorcycle rider fatalities recorded in the EU.

Despite representing a small fraction of vehicle kilometres travelled (about 1.9% of passenger car km), motorcycles and powered two-wheelers still account for a large share of fatalities—much higher than their exposure would suggest (EC, 2023).

Achieving the European Union's Vision Zero objective — namely, a 50% reduction in road traffic fatalities by 2030 and the elimination of road traffic deaths and serious injuries by 2050 — requires a fundamental shift in governance, political commitment, investment strategies, and policy implementation.

This transformation must involve coordinated action by governments at all levels and active participation from all sectors of society, including road users and all stakeholders engaged in road safety. Moreover, every contribution is meaningful and contributes to progress toward these objectives.



TECHNICAL FAILURE IS INSUFFICIENTLY CAPTURED IN OFFICIAL ACCIDENT STATISTICS

National road collision databases typically classify crashes according to contributory human behavioural factors (e.g., excessive speed or failure to yield) and collision typologies (e.g., single- versus multi-vehicle incidents), while mechanical condition or technical failure is rarely included as a primary causal category in publicly available datasets.

Studies based on police-reported accident databases consistently indicate that only a small proportion of motorcycle crashes are primarily attributed to technical defects. For instance, analyses conducted by the Connected Motorcycle Consortium (CMC) using the German In-Depth Accident Study (GIDAS) database show that technical failures account for only 0.8% of powered two-wheeler crashes (CMC, 2022). Comparable low shares, typically in the range of 1–2%, are reported in other European sources (EC, 2017).

By contrast, the Impact Assessment Support Study on the Directives of the Roadworthiness Package (EC, 2025b) assumed a 6% contribution of vehicle technical defects to motorcycle crashes. This figure is two percentage points lower than the contribution level assumed in the 2012 Impact Assessment that supported the proposal for the adoption of the Roadworthiness Package.

The authors of the more recent study considered this reduced rate to be more appropriate in light of evidence from the literature and the observation that the impacts on fatalities and injuries estimated in the 2012 Impact Assessment were substantially higher than those actually observed based on CARE database data.

Furthermore, as part of the sensitivity analysis, alternative assumptions of 3% and 9% were considered. These values are consistent with findings from in-depth technical investigations. Evidence from such investigations suggests that the proportions reported in police-recorded accident databases substantially underestimate the true contribution of vehicle defects to motorcycle crashes. Data from the DEKRA accident database show that technical defects were identified in approximately 20% of motorcycles involved in traffic accidents, compared with 50% for mopeds and around 80% for small mopeds (DEKRA, 2020).

Earlier DEKRA analyses based on detailed examinations of 700 crashed motorcycles between 2002 and 2009 found that 23.6% exhibited technical defects, of which 8% were assessed as accident-relevant, despite rarely being coded as the primary crash cause in official statistics (DEKRA, 2010).



These findings support the conclusion that, while technical defects are seldom the direct cause of motorcycle crashes, they may act as contributory or aggravating factors by increasing crash likelihood or severity.

According to DEKRA expert assessments, the safety-relevant technical deficiencies most frequently affect tyres, braking systems, lighting, steering, and suspension components. In particular, tyre- and brake-related defects are critical, as they directly compromise vehicle stability and braking performance, especially during emergency manoeuvres and cornering situations.

CONSISTENCY OF DEFECT PATTERNS OBSERVED IN CRASHES AND PTI

Data from Member States with motorcycle PTI shows consistently the same defect patterns, mainly related to lighting, braking, and suspension. In fact, most EU Member States already carry out technical inspections on motorcycles. Those that took 'alternative measures' to enhance motorcycle road safety before 20 May 2017, and informed the European Commission, were just Ireland, Finland, and the Netherlands.

The remaining countries without such tests, Belgium, Cyprus, Denmark, France, Malta, and Portugal, did not and, according to the 2014/45/EU, should have therefore implemented periodic technical inspections for larger motorcycles from 1 January 2022. Afterwards, only France introduced a PTI for motorcycles in October 2022. Also, Ireland intends to start with a mandatory PTI inspection for motorcycles, as motorcycle fatalities and serious injuries are a concern in Ireland. That means that only 7 EU member states will not have a PTI for motorcycles.

According to data published by the Kraftfahrt-Bundesamt (KBA, 2025), 11.35% of the more than 1.848 million motorcycles inspected in Germany in 2024 exhibited at least one technical defect. Deficiencies related to lighting systems were the most prevalent, affecting 5.73% of the inspected vehicles.

Defects associated with the axles, wheels, tires, and suspension assembly were identified in 3.33% of the motorcycles, followed by braking system deficiencies, which were observed in 2.14% of cases. Periodic technical inspections for motorcycles have been well established in Germany for many years, which may contribute to a relatively high level of owner preparedness before inspection.



In Belgium, mandatory technical inspections for second-hand motorcycles were introduced in 2023. Data from GOCA Vlaanderen suggest that these figures may provide a more representative overview of the actual technical condition of motorcycles in circulation, as vehicle owners were generally less prepared for the newly implemented inspection regime. In 2023, nearly 24% of the inspected motorcycles failed the inspection due to one or more defects.

In that country, the most frequently recorded deficiencies concerned headlights (11.24%), followed by retroreflectors (4.14%), identification numbers (3.45%), exhaust emissions (1.64%), wheels and tires (1.41%), stop lights (1.25%), turn signals (1.06%), and braking systems (0.84%). In 2024, a modest decrease in defect rates was observed across all categories; however, the overall rejection rate remained substantial, with 22.5% of motorcycles failing the inspection (GOCA Vlaanderen, 2024; 2025).

INCREASING IMPORTANCE OF PTI DUE TO TECHNOLOGICALLY ADVANCED MOTORCYCLES

In recent years, mobility systems have become increasingly connected and automated. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technologies are transforming transportation by enhancing safety, accessibility, and sustainability.

At the same time, this rapid technological progress introduces significant challenges related to system complexity, interoperability, and regulatory oversight. New safety technologies are being introduced, such as the motorcycle-specific eCall system defined within the European I_HeERO project, which establishes minimum requirements for embedded emergency call functionality in motorcycles.

In parallel, advanced rider assistance and safety technologies are expanding to include cornering anti-lock braking systems (ABS), traction control, and radar-supported systems such as blind-spot detection and adaptive cruise control. As a result of this growing technological sophistication, the importance of periodic technical inspection (PTI) becomes increasingly critical to ensure the proper functioning, reliability, and safety of these advanced vehicle systems throughout their operational lifetime.

The introduction of mandatory safety checks would strengthen vehicle maintenance and repair practices, reduce safety failures resulting from inadequate maintenance—such as defects or poor condition of lighting, tyres, and braking systems—and contribute to the prevention of irresponsible tampering. This latter aspect is of particular importance to the European Commission.



The Roadworthiness Package (COM, 2015) specifically aimed to significantly reduce tampering and improve the detection of defective vehicles with faulty or manipulated safety and emission control systems, including tampered odometers.

A high incidence of tampering is observed among motorcycles. In this context, DEKRA Accident Research (2020) compiled inspection results from traffic checks and post-accident investigations in its own database. These inspections frequently identified tuning measures intended to increase maximum vehicle speed, particularly in two-wheeled motor vehicles such as light motorcycles and small mopeds. An analysis covering the period from 2001 to 2018 revealed evidence of illegal technical modifications in 69.5% of small mopeds investigated after accidents and in 32.3% of mopeds examined following accidents.

CONCLUSION: PTI CONTRIBUTES TO ACHIEVING THE EUROPEAN UNION'S VISION ZERO

Although the direct impact of PTI on accident reduction is only limitedly documented, tyre- and brake-related defects are critical factors and are consistently identified in both accident analyses and PTI results. The prevalence of these deficiencies in motorcycle PTI is comparable to that observed in PTI of other vehicle categories.

In the context of achieving the European Union's Vision Zero objective, even incremental improvements in road safety are of relevance. According to the Impact Assessment Support Study on the Directives of the Roadworthiness Package (EC, 2025b), the introduction of periodic technical inspections (PTI), assuming an inspection frequency of 4/2/2, is expected to result in an average reduction in fatalities of 2,2% in those Member States where PTI for motorcycles with an engine capacity exceeding 125 cc is not currently mandatory.

For these reasons, the International Motor Vehicle Inspection Committee (CITA) supports the European Commission's initiative to introduce mandatory PTI for motorcycles (EC, 2025a). This position is shared by the European motorcycle industry, as also advocated by the Association des Constructeurs Européens de Motocycles (ACEM, 2020).

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