/ЧЛАНЦИ

UDC 368.212:629.3.014.9]:347.51; 629.3.014.9

CERIF: S 130

DOI: 10.51204/Anali_PFBU_26201A

Ranko SOVILJ, PhD*

Sanja ZLATANOVIĆ, PhD**

AUTONOMOUS VEHICLES AND THE LIMITS OF TRADITIONAL LIABILITY: BETWEEN LEGAL DOCTRINE AND TECHNOLOGICAL INNOVATION

The paper examines legal liability for damages caused by autonomous vehicles by analyzing the legal and technical characteristics of highly automated and fully autonomous driving systems, as well as the relevant international, regional, and national legal frameworks. While existing motor vehicle insurance and product liability regimes provide an important foundation, they remain fragmented and insufficiently adapted to the technological and normative complexities of autonomous mobility. The paper demonstrates that traditional driver-based liability models are structurally misaligned with highly automated driving, creating systemic gaps in the allocation of liability. Adopting a doctrinal and comparative approach, it highlights the need for a coherent, flexible, and forward-looking regulatory framework capable of reconciling technological innovation with legal accountability. The findings contribute to the ongoing scholarly and policy debates on the future design of liability regimes for autonomous vehicles.

Key words: *Autonomous vehicles*. – *Civil liability*. – *Driver liability*. – *Software manufacturer liability. – Vehicle manufacturer liability*.

---

* Senior Research Associate, Institute of Social Sciences, Serbia, *rsovilj@idn.org.rs*, ORCID iD: 0000–0002–4048–8528.

** Senior Research Associate, Institute of Social Sciences, Serbia, *szlatanovic@idn.org.rs*, ORCID iD: 0000–0001–7753–0876.

1. INTRODUCTION*

The rapid advancement of technology has led to the emergence of autonomous vehicles (also referred to as automated, driverless, self-driving or robotic cars), which operate either fully independently or with a high degree of automation.[1] These vehicles are widely regarded as the future of road transport, with the potential to significantly improve road safety, reduce traffic congestion, and optimize overall traffic flow. Given that approximately 94% of traffic accidents are attributable to human error, widespread adoption of autonomous vehicles is expected to substantially reduce the incidence of road accidents (Chatzipanagiotis, Leloudas 2020, 112). Additionally, autonomous vehicles may contribute to lower emissions in urban areas, reduced fuel consumption, and enhance mobility for individuals who are unable to drive (e.g., the elderly, persons with disabilities, and individuals under the influence of alcohol and/or psychoactive substances) (Kordić *et al*. 2017, 230).

Rapid technological progress in this field gives rise to complex legal, economic, and societal challenges across multiple regulatory domains. In particular, the transition from human-operated vehicles to those driven by artificial intelligence (AI) fundamentally challenges traditional doctrines of fault and liability, rendering the attribution of liability in the event of an accident increasingly uncertain (Dumančić, Vuletić 2025, 65). These developments also have significant implications for the insurance sector, which must adapt its risk assessment models and regulatory frameworks to the realities of automated mobility. Moreover, the widespread adoption of autonomous vehicles is likely to affect labor markets, particularly in transport-related professions (e.g., taxi services), while simultaneously generating demand for highly specialized technical expertise (Janković, Sovilj, Zlatanović 2025, 73–92).

* This paper was produced as part of the 2026 Research Program of the Institute of Social Sciences supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

1 The terminology used in relation to autonomous vehicles is not always consistent across legal and technical discourse, as the terms in question are frequently used interchangeably. In particular, “autonomous” and “automated” vehicles are often employed as synonymous expressions not only in the media and broader society, but also in industry and academia. Although certain regulatory frameworks, including those developed under the auspices of the UNECE, tend to favor the term “automated vehicle”, this distinction is not merely semantic, as it may reflect differing assumptions regarding the degree of independence of the driving system and the residual role of the human operator (Fernandez-Llorca 2021, 1).

Against this background, the integration of autonomous vehicles into road transport systems necessitates a reassessment of existing liability regimes. The central focus of this paper is therefore the analysis of the legal liability for damage caused to third parties by autonomous vehicles. The paper commences with an examination of the legal and technical characteristics of autonomous driving systems and proceeds, through a doctrinal and comparative legal analysis, to evaluate international, European Union (EU), and national liability frameworks with a view to assessing the evolving allocation of liability in autonomous vehicle operation.

Despite the growing body of literature on autonomous mobility, the relationship between international, EU, and national liability regimes in the context of AI-driven driving systems remains only partially clarified. This paper proceeds from the hypothesis that existing international and EU liability frameworks, in particular those based on product liability and motor vehicle insurance, are not fully adequate to address the specific challenges posed by autonomous vehicles, thereby necessitating the development of a more coherent and adaptive regulatory approach. A central issue concerns how decisions generated by AI systems may lead to traffic accidents and the legal justification for assigning liability to vehicle owners in such circumstances. Accordingly, this paper aims to examine the legal framework governing the introduction of highly automated and fully autonomous vehicles in the EU and Serbia. It further analyzes safety considerations from the perspective of end users and evaluates the realistic prospects for the deployment of higher-level autonomous vehicles. By analyzing international, EU, and national regulatory frameworks, this paper seeks to contribute to ongoing debates on the adaptation of liability regimes to automated mobility.

Given the still-developing nature of these technologies, a harmonized international regulatory framework has yet to be established. Instead, states regulate autonomous vehicles through national legal instruments, guided by general safety principles. Building upon these broader international and European developments, many countries are actively investing in and regulating autonomous driving technologies. The Republic of Serbia, following the example of jurisdictions such as the United States, and Germany, has taken initial regulatory steps through amendments to the Law on Road Traffic Safety[2] and the adoption of the Rulebook on Conditions

[2] Law on Road Traffic Safety, *Official Gazette of the RS* 41/2009, 53/2010, 101/2011, 32/2013 – decision of the CC, 55/2014, 96/2015 – other law, 9/2016 – decision of the CC, 24/2018, 41/2018, 41/2018 – other law, 87/2018, 23/2019, 128/2020 – other law, 76/2023 and 19/2025.

for Autonomous Driving.[3] These instruments establish a preliminary legal framework, currently limited to permitting the testing of autonomous vehicles on public roads.

2. THE CONCEPT AND CLASSIFICATION OF AUTONOMOUS VEHICLES

Autonomous vehicles represent a new generation of motor vehicles capable of operating independently, either without human intervention or with only minimal driver involvement. An autonomous vehicle may be defined, in technical terms, as a system capable of navigating without direct human control, dynamically adapting to changes in its immediate environment, and proceeding along a predetermined route toward a designated destination (Murphy 2000, 4).

However, no universally accepted legal definition of autonomous vehicles exists currently. Regulatory approaches vary across jurisdictions, often reflecting differing policy priorities and levels of technological development. Within the European context, relevant normative guidance may be found in the regulatory framework developed by the EU, as well as in international instruments adopted under the auspices of the UNECE, particularly within the framework of the World Forum for Harmonization of Vehicle Regulations (UNECE 2024). Regulation (EU) 2019/2144 refers to an automated vehicle, which means "a motor vehicle designed and constructed to move autonomously for certain periods of time without continuous driver supervision but in respect of which driver intervention is still expected or required,"[4] and a fully automated vehicle, which means "a motor vehicle that has been designed and constructed to move autonomously without

[3] Rulebook on Conditions for Autonomous Driving, *Official Gazette of the RS* 104/2023.

[4] Regulation (EU) No. 2019/2144 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166, *OJ L* 325 of 27 November 2019, Art 3 (21).

any driver supervision."[5] Pursuant to the Serbian Law on Road Traffic Safety, an autonomous vehicle is defined as a manufactured or modified motor vehicle equipped with an automated driving system that satisfies prescribed technical and other requirements and is capable of operating in road traffic either under partial driver control or without any driver control.[6] Notwithstanding these definitions, particular challenges arise in relation to the traditional concepts of "driver" and "control", which form the basis of traditional traffic regulation, including the Vienna Convention on Road Traffic.[7] In systems involving higher levels of automation, the extent to which a human occupant can still be regarded as exercising control over the vehicle becomes increasingly ambiguous, thereby raising important questions of legal qualification even at the definitional level. Taken together, these instruments do not provide a single, consolidated definition, but rather regulate specific aspects of automated driving systems, thereby contributing to a fragmented yet evolving legal understanding of the concept.

Artificial intelligence constitutes a fundamental and indispensable component in both the development and operational functioning of such vehicles. Autonomous vehicles rely on complex technological architectures comprising cameras, radar sensors, and laser-based systems (e.g., LiDAR), which enable the detection and interpretation of the surrounding environment, including vertical and horizontal traffic signage, as well as the presence and behavior of other road users (Kajtez 2014, 17). In addition, pre-existing geospatial data, such as that derived from mapping platforms (e.g., Google Street View), facilitates advance route planning through detailed analysis of road networks and intersections.[8]

5 *Ibid.*, Art 3 (22).

6 Law on Road Traffic Safety, Art. 7, para. 1.

7 Convention on Road Traffic, concluded in Vienna on 8 November 1968, Art. 1 (v).

8 During operation, the vehicle continuously collects and processes real-time data from its environment, allowing it to respond appropriately to dynamic traffic conditions. Through the integration of ultrasonic sensors, computer vision systems, and Global Positioning System (GPS) technology, autonomous vehicles are capable of following mapped routes while accounting for relevant events and obstacles. More advanced systems further possess the capability to autonomously update routing decisions on the basis of sensor-derived information. Video processing technologies play a crucial role in lane detection, determining the vehicle's position relative to lane boundaries, and estimating distances to surrounding road users. These functions collectively enable the safe operation of the vehicle without direct human control (Kajtez 2014, 17). Accordingly, autonomous vehicles are designed to perform all essential driving functions traditionally carried out by a human driver, particularly those related to environmental perception, decision-making, and

In this regard, an autonomous vehicle is best understood as the product of the integration of multiple sensor systems into a unified technological framework that enables the vehicle to "perceive" its environment and adjust its behavior accordingly in real time.[9] These vehicles combine advanced sensing technologies with sophisticated software systems responsible for control, navigation, and driving functions. In this context, the concept of the Operational Design Domain (ODD) is of particular relevance. Autonomous vehicles are typically designed to operate only under specific predefined conditions, such as certain types of roads, weather conditions, or traffic environments (Mendiboure *et al*. 2023, 1). This limitation is significant not only from a technical standpoint but also from a legal perspective, as it delineates the scope within which autonomous operation is considered permissible. In this sense, the ODD effectively functions as a de facto boundary of lawful system deployment, linking technical capability with regulatory permissibility (Mehlhorn, Richter, Shardt 2023, 2205).

Accordingly, autonomous driving exists on a spectrum of technological capability, ranging from basic driver assistance to full automation. A widely accepted classification framework has been developed by the SAE (Society of Automotive Engineers), a global association of engineers and technical experts in the aerospace, automotive, and commercial vehicle sectors. This framework distinguishes six levels of driving automation based on the degree of system autonomy. The criteria for determining the level of automation relate to who is in continuous control of the vehicle, whether

---

vehicle control. Within such a framework, the role of the human operator is reduced to selecting a destination, after which the autonomous system assumes primary liability for vehicle operation.

9 Certain sensor technologies currently employed in autonomous vehicles have long been present in conventional passenger and commercial vehicles, including satellite navigation systems and ultrasonic sensors used for detecting obstacles in the vehicle's immediate surroundings. In traditional applications, such systems typically operate either independently or within lower levels of automation, primarily serving to assist the driver (e.g., lane-keeping assistance, parking support, and adaptive cruise control). Notwithstanding these advancements, a significant limitation of current autonomous vehicle technology lies in the insufficient reliability of environmental perception systems under complex driving conditions. In particular, such systems have not yet achieved the level of accuracy required for safe operation in dense traffic or across all weather conditions. Camera-based systems may be adversely affected by glare, low visibility, or atmospheric disturbances such as fog or smoke, thereby impairing environmental interpretation. Ultrasonic sensors are limited by short detection ranges and low resolution, while LiDAR (Light Detection and Ranging) systems, although capable of generating detailed three-dimensional representations of the environment, are subject to constraints including limited range and reduced performance under adverse weather conditions, especially heavy precipitation (Jones Day 2021, 4).

it is the automated driving system (ADS) or the human driver, as well as which driving functions are performed with the support of the ADS. In legal analysis, this framework supports a functional approach that focuses on the allocation of driving tasks rather than on formal system labels (Milenković, Sumpor, Tokić 2025, 4). Under this classification, Level 0 denotes the absence of automation, while Level 5 represents full automation.[10] The intermediate levels are defined as follows: Level 1 (driver assistance), Level 2 (partial automation),[11] Level 3 (conditional automation),[12] and Level 4 (high or full automation under specific conditions). The first three levels (SAE Levels 1–3) are generally regarded as forms of driver assistance, whereas Level 4 systems are capable of self-driving within defined operational domains without human intervention in most circumstances (Doskoch 2023, 3).

---

10 Level 5 (full automation) refers to the continuous performance by an automated driving system of all aspects of the dynamic driving task across all roadway and environmental conditions that a human driver could manage (Leiman 2021, 254).

11 Level 2 corresponds to partial driving automation and encompasses advanced driver assistance systems operating in real traffic conditions. At this level, the vehicle is capable of simultaneously controlling both steering and acceleration or deceleration. Nevertheless, Level 2 automation does not constitute fully autonomous driving, as the presence and active supervision of a human driver remain indispensable. The driver is required to monitor the driving environment continuously and must be prepared to assume control of the vehicle at any moment. Prominent examples of systems classified at this level include Tesla Autopilot and Cadillac Super Cruise, both of which illustrate the current capabilities and limitations of partial automation in practice (ADAS 2024).

12 Level 3 actually represents conditional automation since the autonomous driving system can make decisions based on information and perform operational driving tasks (e.g., accelerating past a slow-moving vehicle), while the driver plays the role of a backup user and must be constantly alert and ready to take over if the system is unable to perform the task (Chatzipanagiotis, Leloudas 2020, 113). Audi was among the first to launch a vehicle with Level 3 autonomous driving. In the middle is the premium Audi A8 (D5) sedan presented in 2017 in its fourth generation. The A8 features Traffic Jam Pilot, which combines a LiDAR scanner with advanced sensor fusion and processing power. Traffic Jam Pilot allows the car to move independently in traffic and on the highway up to a speed of 60 km/h. However, due to still non-existent legal provisions, Audi pushed back the launch of the A8 in the US market in 2019 (Karkafiris 2017). Mercedes-Benz achieved technology corresponding to Level 3 automation (Mercedes-Benz Drive Pilot) as early as 2017. However, due to restrictive EU regulations and regulatory challenges in Germany, the company shifted its focus toward the development of autonomous vehicles for markets outside the EU, while cooperating with companies such as Google, Microsoft, and Matterport (Mrvić Petrović 2023, 36). In 2023, Mercedes-Benz became the first manufacturer to obtain regulatory approval for a Level 3 automated driving system in a series-production vehicle (S class W223 and EQS) for use on public roads in the United States, with Nevada as the first state to certify the system's compliance with applicable state regulations (Mercedes Benz 2023).

Notwithstanding its widespread acceptance, the SAE classification has been subject to considerable criticism in legal and academic literature. In particular, it has been argued that the framework is primarily technical in nature and does not adequately capture the allocation of liability between human drivers and automated systems. Level 3 automation, in particular, has been criticized for creating ambiguity regarding the division of control and the corresponding attribution of liability (Leiman 2021, 255). Furthermore, the SAE taxonomy does not possess binding legal force and has been incorporated into regulatory frameworks only indirectly and inconsistently. These limitations have led some scholars to question its suitability as a basis for legal analysis and regulatory design (Leiman 2021, 258).

Finally, it should be noted that autonomous vehicles differ fundamentally from traditional motor vehicles in that they incorporate complex software systems capable of continuous development and updates. This dynamic characteristic further complicates legal classification, as the functional capabilities of the vehicle may evolve over time, thereby challenging static regulatory definitions and necessitating a more flexible legal approach (Yang, Song 2025, 10).

3. LEGISLATIVE AND REGULATORY DEVELOPMENTS PERTAINING TO AUTONOMOUS VEHICLES

Since the late 2000s, substantial progress has been achieved in both autonomous vehicle technology and the regulatory framework governing them. Major companies, including Google, Continental Automotive Systems, Nissan, Toyota, Audi, and Mercedes-Benz, developed operational autonomous vehicle prototypes, prompting early legislative responses in several U.S. states.

In 2011, Nevada became the first U.S. jurisdiction to authorize autonomous vehicles on public roads through Assembly Bill 511 (Anderson *et al*. 2016, 41). The law empowered the Nevada Department of Motor Vehicles (NDMV) to establish safety standards, regulate testing, and issue specialized driving permits. It further recognized that an engaged automated driving system performs the functions otherwise required of a human driver under traffic law, while also preventing local authorities from imposing additional regulatory burdens. Although autonomous operation did not require continuous human attention, testing required the presence of a person in the driver's seat capable of taking control of the vehicle (Anderson *et al*. 2016, 42). In May 2012, the NDMV issued the first permit for a Toyota Prius modified by Google with experimental driverless technology, allowing a human operator to assume control at any time by pressing the brake pedal or turning the steering wheel (Garthwaite 2012). Nevada thereby established the first comprehensive legal framework facilitating autonomous vehicle testing and development.

California adopted a more precautionary regulatory model through Senate Bill 1298 in 2012.[13] The legislation authorized the California Department of Motor Vehicles (CDMV) to regulate testing and deployment, requiring manufacturers to obtain prior approval, satisfy safety standards, maintain insurance coverage, and comply with registration obligations (Doskoch 2023, 5). While the law permits autonomous vehicle operation without a human driver only after CDMV approval, it mandates that a licensed driver remain in the driver's seat to assume control in the event of system failure, thereby ensuring that human intervention remains available where automated functions cannot safely complete the driving task (Frisman 2012, 3).

By contrast, Florida adopted one of the most permissive autonomous vehicle regimes in the U.S. Florida law expressly recognized the automated driving system itself as the legal "operator" of the vehicle and permits fully autonomous operation without a human physically present in the vehicle (Anderson *et al*. 2016, 45). At the same time, the legislation required compliance with federal safety standards and the capability to achieve a minimal-risk condition in case of system failure. Moreover, Florida law expressly states that "the State does not prohibit or specifically regulate the testing or autonomous operation of vehicles on public roads," thereby underscoring the permissive nature of its regulatory framework (Anderson *et al*. 2016, 46).

In the EU, the strategic necessity of guiding the development and deployment of emerging technologies, particularly in the automotive and transport sectors, is formally recognized in the European Commission Communication of 17 May 2018 entitled Sustainable Mobility for Europe:

[13] It is noteworthy that San Francisco, otherwise regarded as a leading hub for technological innovation, has expressed dissatisfaction with the regulatory approach adopted by the State of California with respect to the permissiveness of testing emerging technologies on public roads. In late 2023, the city initiated proceedings against the state, alleging that its regulatory framework for the deployment of autonomous vehicles is unsafe and disruptive. San Francisco has called for the suspension of autonomous vehicle operations on its streets until a clear and comprehensive legal framework that adequately ensures the safety and protection of all road users is established (Mudrić 2024).

Safe, Connected and Clean,[14] which sets out a strategy for the roll-out of connected and automated vehicles in Europe, On the road to automated mobility: An EU strategy for the mobility of the future.[15] This strategic approach is reinforced in the communication entitled A Strategy for Sustainable and Smart Mobility – putting European transport on track for the Future.[16] The 2018 Strategy underscores the critical need to further harmonize traffic rules and implement safety measures to protect pedestrians, cyclists, and motor vehicle operators during the transitional period in which conventional and autonomous vehicles share roadways (Mrvić Petrović 2023, 31). It recognizes the emergence of new risks related to human factors and the complex interactions between human drivers and automated systems. The anticipated increase in the presence of autonomous vehicles necessitates particular attention to vehicle construction standards, the enhancement of "smart" road infrastructure, and the improvement of traffic signaling, with specific emphasis on horizontal signaling systems (Mrvić Petrović 2023, 31).

In addition to outlining strategic objectives, the EU has commenced the development of specific legal and regulatory instruments that directly impact the deployment and legal treatment of autonomous vehicles. A key milestone is Regulation (EU) 2019/2144 on type-approval requirements for motor vehicles and their trailers, which entered into force on 6 July 2022. This Regulation introduces a comprehensive legal framework for the approval of automated and autonomous driving systems, integrating safety and cybersecurity requirements applicable at the EU level.[17] The provisions

[14] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Europe on the Move: Sustainable Mobility for Europe: safe, connected, and clean, COM (2018) 293 final, 17 May 2018.

[15] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and Social Committee and the Committee of the Regions, On the road to automated mobility: An EU strategy for mobility of the future, COM (2018) 283 final, 17 May 2018.

[16] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Sustainable and Smart Mobility Strategy – putting European transport on track for the future, COM (2020) 789 final, 9 December 2020.

[17] Regulation (EU) No. 2019/2144 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users.

extend beyond traditional type-approval criteria to encompass advanced driver assistance systems and future driverless technologies, thereby laying the groundwork for harmonized safety standards across Member States.

The existing EU legislative framework interacts with broader liability and insurance regimes, within which general vehicle insurance and third-party liability obligations continue to apply to autonomous vehicles under current EU law. At the same time, the traditional product liability regime, as established by the Product Liability Directive 85/374/EEC, has long imposed strict liability on manufacturers for defective products that cause physical harm to consumers, including those integrating software components.[18] However, the rapid evolution of automation and the increasing deployment of artificial intelligence systems have exposed significant regulatory gaps in the allocation of liability and the effective compensation of victims. In particular, the application of existing product liability rules to AI-driven technologies remains uncertain, due to the blurring of boundaries between products and services, as well as the complex and often opaque ecosystem of actors involved at different stages of the AI lifecycle (Toman 2023, 715). In response, the European Commission has proposed initiatives aimed at modernizing non-contractual civil liability rules to address harms caused by AI systems, including those deployed in autonomous vehicles, notably by introducing mechanisms such as a rebuttable presumption of causality to facilitate victims' access to compensation.[19] These regulatory developments must be understood within the broader context of ongoing EU efforts to align liability frameworks for emerging automated mobility technologies with relevant international standards. They are further situated within a wider policy discourse in which regulatory approaches are increasingly complemented by ethical and governance principles for AI, including those reflected in the EU's Artificial Intelligence Act,[20] with the aim of ensuring

[18] The new Product Liability Directive (EU) 2024 was adopted in 2024, with a transposition deadline requiring Member States to implement its provisions into their national legal orders by 9 December 2026. The previous Product Liability Directive 85/374/EEC will remain in force until that date (Dumančić, Vuletić 2025, 67).

[19] The European Commission in 2022 published the Proposal for a Directive on adapting non-contractual civil liability rules to artificial intelligence (the "AI Liability Directive"), aimed at modernizing existing liability frameworks to effectively address damage caused by AI systems, including those used in autonomous driving. The proposal introduces, inter alia, a rebuttable presumption of causality and facilitates enhanced access to evidence for claimants (Hacker 2023, 10). The proposal was subsequently withdrawn in 2025, thereby halting its legislative progression.

[20] Regulation (EU) No. 2024/1689 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives

the responsible deployment of autonomous vehicles. Taken together, these developments reflect the EU's dual objective of fostering technological innovation in automated mobility while maintaining a high level of safety, legal certainty, and consumer protection across the Union.

4. RECONCEPTUALIZING LIABILITY IN HIGHLY AUTOMATED DRIVING

4.1. From Fault-Based to Risk-Based Liability: Foundations of Objective Liability

In light of the foregoing regulatory developments, it becomes necessary to reconsider the traditional foundations of liability in the context of highly automated driving. Certain European legal systems, such as those of France and Serbia, recognize a general principle of strict (objective) liability; rather than enumerating specific dangerous objects or hazardous activities, the legislature formulates a general rule defining the conditions for its application.[21] The precise scope of this general norm is subsequently developed through judicial interpretation, as courts construe the statutory criteria for the imposition of objective liability and assess their application to the facts of individual cases (Karanikić Mirić 2016, 189).

In order to ascertain the contours of liability for damage caused by autonomous vehicles under the positive law of Serbia, it is necessary to examine the existing legal framework governing liability for damage arising from the use of motor vehicles, as well as liability for harm caused by dangerous objects.[22] The general rule on objective liability is set out

2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance), *OJ L* of 13 June 2024.

[21] Strict liability denotes a form of legal liability for harm arising from the materialization of an abnormal or atypical risk situated within the defendant's sphere of control. Where such a risk, imputable to the defendant, results in damage to others, liability is imposed irrespective of any finding of fault (Karanikić Mirić 2017, 346).

[22] In earlier legal literature, the nature of this form of liability has been interpreted in different ways. According to one view, such liability does not concern the conduct of the owner or keeper of the vehicle; rather, it is not necessary for the damage to have been caused by their actions, but instead by the operation of the vehicle itself. Under this approach, the presumption of liability is grounded in the causal link between the functioning of the vehicle and the damage, rather than between human conduct and the harmful outcome. By contrast, another line of reasoning attributes damage caused by a motor vehicle to the driver, on the basis that the

in Article 154 para. 2 of the Law on Obligations (LOO), while the broader regime applicable to damage caused by things or activities posing an increased risk is elaborated in Articles 173–177 LOO.[23] The legislature did not provide an exhaustive list of dangerous things or activities; instead, their hazardous nature is typically indicated indirectly, through the imposition of liability irrespective of fault. Where the law does not explicitly classify a particular thing or activity as dangerous, this determination is left to judicial assessment (Karanikić Mirić 2016, 189).

The courts are thus empowered to classify a given thing or activity as dangerous and to resolve liability for the resulting damage on the basis of the objective principle. In Serbian judicial practice, a motor vehicle in motion is consistently regarded as a dangerous thing, and its owner is held liable for damage caused by its operation under a regime of strict liability. Accordingly, liability for damage caused by a motor vehicle does not constitute a distinct form of objective liability, but rather represents a paradigmatic application of its general form (e.g., situations where a motor vehicle hits a pedestrian, cyclist, parked vehicle, fence, or building) (Karanikić Mirić 2016, 190).

The owner may be exonerated upon demonstrating that the damage was caused by an external factor originating outside the object, the effects of which could neither have been foreseen nor prevented. Similarly, exculpation is available where the damage is attributable exclusively to the conduct of the injured party or a third person, provided that such conduct was unforeseeable and that its consequences could neither have been avoided nor averted.[24] Accordingly, liability for damage caused by a dangerous object constitutes a regime of strict liability, marking a clear departure from the fault-based principle that traditionally underpins the law of torts (Sovilj 2024, 39).

In light of rapid technological developments, particularly the widespread deployment of artificial intelligence – characterized by high technical complexity, opacity, and limited human control – the risk of harm has increased significantly, rendering the application of subjective (fault-based) liability often both inequitable and impracticable. In this context, strict

vehicle merely constitutes an instrument in human hands. From this perspective, the owner or keeper of the vehicle is not liable for the "behavior" of the vehicle as such, but for their own conduct, or for the conduct of other persons – road users (Radišić 1976, 15–16).

[23] Law on Obligations, *Official Gazette of the SFRY* 29/78, 39/85, 45/89 – decision CCY and 57/89, *Official Gazette of the FRY* 3/93, *Official Gazette of SCG* 1/2003 – Constitutional charter, and *Official Gazette of the RS* 18/2020. Arts. 154, 173–177.

[24] Law on Obligations, Arts. 174–177.

liability operates as a corrective mechanism in situations involving the use of objects that pose an increased risk to the environment, ensuring that injured parties receive effective and timely compensation for the damage sustained (Belanić, Milisavljević 2023, 15). The rise of autonomous systems thus reflects a broader shift from fault-based liability toward risk-based and system-oriented models of liability.

4.2. Driver-Centric and Transitional Liability Regimes in Levels 2 and 3 Automation

Before addressing the legal challenges posed by higher levels of automation, it is advisable to briefly consider Level 2 driving automation, which remains firmly embedded within the traditional liability framework. Level 2 driving automation does not fundamentally alter the allocation of legal liability. Notwithstanding the vehicle's capability to control both steering and acceleration or deceleration simultaneously, the human driver remains the primary bearer of legal liability for the safe operation of the vehicle. In this context, the driver is subject to a continuous duty of supervision, requiring the active monitoring of both the driving environment and the functioning of the automated system (Ba, Zhao, Zhang 2025, 1).

The obligation to remain attentive and prepared to intervene at all times constitutes a defining feature of Level 2 automation. Failure to comply with this duty may give rise to liability under general principles of road traffic law, the rules governing mandatory motor vehicle liability insurance, and the general rules on the civil liability of the owner or keeper of a vehicle for damage caused by a dangerous object. This is because the use of any vehicle – whether conventional or autonomous – is associated with comparable risks of property damage, personal injury, or death of road users (Mrvić Petrović 2023, 38). Accordingly, the use of systems such as Tesla Autopilot or Cadillac Super Cruise does not entail a transfer of legal liability from the driver to the manufacturer or software provider (Widen, Wolf 2025, 2). Courts and regulatory authorities generally classify such systems as advanced driver assistance tools rather than genuine substitutes for human control. Nevertheless, specific legal complexities may arise in cases involving system malfunctions, inadequate warnings, or misleading representations concerning the capabilities of the technology. In such circumstances, issues of concurrent or product liability may emerge, potentially engaging the liability of manufacturers under applicable product liability and consumer protection laws.[25] However, such liability does not, as a rule, exclude or diminish the driver's primary liability where the duty of supervision has not been duly exercised.

While Level 2 automation remains firmly anchored in the traditional paradigm of driver liability, the transition to Level 3 automation marks a significant conceptual shift in the allocation of control and liability. From a legal standpoint, Level 3 (conditional automation) introduces a qualitatively distinct and more complex allocation of liability compared to lower levels of automation. While the automated system assumes control over the dynamic driving task within a defined operational domain, the human driver retains the role of a fallback user, thereby creating a dual-layered and inherently unstable control structure (Leiman 2021, 254).

One central legal issue concerns the scope and content of the driver's duty to intervene. Unlike Level 2 systems, which require continuous supervision, Level 3 permits the driver to disengage from ongoing monitoring under normal operating conditions, while still imposing a residual duty to respond to system-issued takeover requests. The allocation of liability therefore depends on factors such as the timeliness and clarity of the warning, as well as the driver's ability to reassume control within a reasonable time frame (Mrvić Petrović 2023, 39). This framework gives rise to significant evidentiary and normative challenges, most notably in relation to how the standard of care should be defined in highly automated driving environments. Courts must assess whether the driver, regardless of whether they were distracted, cognitively or physically impaired, disabled, or fully attentive, had a realistic and effective opportunity to intervene, taking into account human reaction times, situational awareness, and the design of the human-machine interface (Uzair 2021, 5). Where warnings are inadequate or untimely, liability may shift, at least in part, to the manufacturer or software developer under product liability regimes, although the driver is not entirely relieved of liability due to the persisting duty of readiness to intervene.[26] The precise scope of this duty remains subject to ongoing regulatory development and judicial interpretation, rather than settled doctrinal consensus.

---

[25] For instance, in a 2019 Florida crash involving Tesla's Autopilot system, a federal jury apportioned partial liability to Tesla and awarded over $329 million in damages, suggesting that the system's design, performance, and warning mechanisms were scrutinized as potential contributing factors under a product liability framework, rather than the incident being attributed solely to driver error (Kolodny 2025).

[26] In Level 3 autonomous vehicle accident cases, Ontario's Negligence Act provides multiple options for assessing proportional fault. Courts evaluate each party's degree of fault based on the specific facts and causation and may impose joint and several liability where necessary to ensure that victims receive full and timely

Given these uncertainties, the literature presents several competing models of liability allocation. A dominant view maintains that primary liability should remain with the driver in order to preserve consistency in traffic safety and behavioral standards (Widen, Wolf 2025, 1). By contrast, an alternative approach argues for a differentiated standard of care based on the system's level of autonomy, assigning greater liability to manufacturers while correspondingly limiting the driver's obligations. A more nuanced position links liability to the driver's actual intervention: where the driver actively overrides or influences the system, the driver's standard of care becomes determinative; where no such intervention occurs, liability may more appropriately rest with the manufacturer or system operator (Ba, Zhao, Zhang 2025, 2). In this context, several scholars propose that, following driver intervention, liability should be assessed by reference to the degree of control exercised, the reasonableness of the driver's conduct, and the establishment of causation between the intervention and the resulting harm. Concurrently, it is maintained that manufacturers should be afforded a reasonable scope of statutory defenses so as to ensure proportionality and fairness in risk allocation (De Bruyne, Werbrouck 2018, 1151).

Simultaneously, issues of product liability and regulatory compliance become increasingly salient at this level. Deficiencies in system design, inadequate risk communication, or misleading representations concerning system capabilities may give rise to manufacturer liability, particularly where such shortcomings contribute to the driver's failure to intervene in a timely manner. Accordingly, Level 3 automation represents a transitional phase in the evolution of autonomous driving, characterized by a hybrid allocation of liability that challenges traditional doctrines of fault and liability. This ultimately confirms that Level 3 automation exposes the structural limits of driver-centric liability models, as liability is neither fully retained by the driver nor effectively transferred to the manufacturer, thereby necessitating a more nuanced, adaptive, and technologically responsive legal framework.

4.3. The Erosion of Driver Liability: Levels 4 and 5 Automation

As the degree of automation increases, the role of the human driver in vehicle operation progressively diminishes and is effectively eliminated at Levels 4 and 5, where the human occupant, if present, no longer performs any

compensation (Ba, Zhao, Zhang 2025, 8).

driving function and is more accurately described as a passenger or passive user (Sovilj 2024, 40). In such conditions, liability frameworks premised on driver control become increasingly untenable from a legal standpoint, as the traditional conceptual category of the “driver” ceases to correspond to any meaningful degree of operational authority or liability.[27]

This departure from the traditional paradigm raises serious normative and doctrinal concerns regarding liability. In particular, it necessitates a fundamental reconsideration of whether it is justifiable, from the standpoint of both fairness and legal policy, to hold the owner or user liable for damage caused by a system over which they lack meaningful control. Pursuant to the theory of created risk, the owner incurs liability for damage sustained by third parties on the basis of the risk inherently generated by the operation of the vehicle, irrespective of fault. This approach reflects a departure from fault-based liability and is grounded in the principle that the party who introduces a source of increased danger into the public sphere should bear the legal consequences of the risks thereby created (Belanić, Milisavljević 2023, 14). Under this framework, it is, in principle, immaterial whether the vehicle is conventional or autonomous; the owner’s liability arises simply from possessing a vehicle that creates operational risk (Belanić, Milisavljević 2023, 14–19). In this sense, the cause of the damage is presumed to reside in the dangerous object itself, namely, the vehicle, including, where applicable, the autonomous system that governs its operation. An additional argument in favor of imposing objective liability upon the owner of an autonomous vehicle lies in the enhanced protection afforded to injured parties. Such a regime facilitates more effective access to compensation, as claimants are able to pursue recovery against the owner directly, rather than confronting the significantly more complex task of establishing liability on the part of the vehicle manufacturer or the developer of the underlying software (Sovilj 2024, 21).

From a legal perspective, Level 4 automation marks a decisive shift in the allocation of liability, as the operational control of the vehicle is fully transferred to the automated driving system within its defined operational design domain. At this level, the human driver no longer performs any dynamic driving task, and traditional liability models premised on human control are therefore displaced by system-centered governance of driving functions. As a result, the applicable legal framework moves away from driver-based

[27] In the context of accidents involving motor vehicles operating at Levels 0–2, where liability can be attributed exclusively to the fault of the vehicle owner, the general rules of fault-based liability apply. In such cases, the injured party is entitled to seek compensation directly from the vehicle owner (Law on Obligations, Art. 178).

fault attribution and is more appropriately grounded in product liability. The law is thus no longer primarily concerned with human error, but with the adequacy, safety, and reliability of the automated driving system itself as the primary locus of control.[28] Within this framework, liability may attach to the manufacturer, software developer, or system operator where the accident can be linked to identifiable system deficiencies (Marchant, Lindor 2012, 1327).[29] Such deficiencies may include design defects, inadequate validation or testing procedures, insufficient safety redundancies, failure to properly communicate system limitations, or errors in post-deployment software updates (Gurney 2013, 258). Accordingly, liability assessment at Level 4 is structured around system performance and compliance with applicable safety standards, rather than individual human conduct.

At Level 5, this transformation reaches its logical conclusion. Fully autonomous vehicles eliminate the need for any human involvement in the driving task, thereby rendering the attribution of liability to the owner or user highly problematic, if not conceptually unsustainable (Pellegatta 2019, 143). It is neither normatively convincing nor ethically justified to impose full civil or even criminal liability on individuals who merely occupy the vehicle.[30] This applies even if they are absent or incapable of influencing

[28] At the same time, the delimitation of the operational design domain assumes critical legal significance. Where a vehicle operates outside the conditions for which it was designed, such as specific geographic areas, weather conditions, or traffic scenarios, questions arise as to whether liability should be mitigated or redistributed, especially where such operation results from user misuse or insufficient system safeguards. Moreover, emerging regulatory frameworks increasingly mandate the use of event data recorders and transparency mechanisms to facilitate post-incident analysis and the attribution of liability (Razdan *et al*. 2025, 10). These developments reflect a broader shift toward a system-oriented model of liability, in which liability is distributed among multiple actors rather than concentrated on an individual driver.

[29] In 2019, France adopted the Mobility Orientation Law (*Loi d'Orientation des Mobilités*), which establishes the legal framework governing the regulation and operation of autonomous vehicles, including those classified as Level 4 automation according to the SAE standards. Pursuant to this law, liability for vehicles equipped with a high degree of automation is, as a general rule, attributed to the operator of the automated driving system. The term "operator" denotes a natural or legal person responsible for the management of an autonomous mobility service, including the oversight of the vehicle's safe operation and proper functioning during periods of automated driving. Article 31 of the Law sets forth the conditions under which autonomous vehicles may be authorized to operate on public roads, including, inter alia, provisions concerning the allocation of responsibilities to operators and the applicable insurance obligations (Milenković, Sumpor, Tokić 2025, 7).

[30] A recent 2026 incident involved a Waymo autonomous vehicle that struck a child near a school in Santa Monica, prompting an investigation by the U.S. National Highway Traffic Safety Administration into whether the system exercised adequate

its operation (for instance, children, individuals with significant cognitive impairments, or those under the influence of alcohol or psychoactive substances). Such an approach would not only undermine the principles of fairness but could also hinder the broader societal acceptance and adoption of fully autonomous technologies.

However, the deployment of fully autonomous vehicles remains significantly constrained across most jurisdictions, primarily due to the absence of comprehensive regulatory frameworks, as well as limitations in institutional capacity and transport infrastructure. Consequently, their operation is, at present, largely confined to controlled environments, such as designated urban zones, where additional safeguards are implemented and operational parameters, most notably speed, are typically restricted (Butilă *et al*. 2026, 3).

4.4. Comparative Insights: The German Regulatory Model

In this context of normative uncertainty and limited practical deployment, the German legal framework constitutes a particularly salient and sophisticated effort to reconcile traditional doctrines of liability with the realities of highly automated driving, thereby offering a valuable comparative reference point for the development of emerging regulatory regimes. Under German law, primary liability rests with the vehicle owner, whose compulsory motor vehicle liability insurance covers both personal injury and property damage arising from the use of the vehicle, irrespective of whether it is conventional or highly automated (SAE Level 4). The 2021 Autonomous Driving Act, which authorizes the operation of vehicles equipped with autonomous driving functions within a defined operational area, at the same time relieves the user of specific operational duties. However, in light of Article 8(5bis) of the Vienna Convention on Road Traffic, which requires that a human must retain the ability to deactivate the automated system, whether from within or outside the vehicle, German legislation introduces the novel role of a "technical supervisor", entrusted, inter alia, with the authority to deactivate the automated driving system, thereby assuming a function traditionally attributed to the driver (Ebers 2022, 8). In addition, the technical supervisor is subject to separate insurance obligations. Questions of causation and fault are assessed on a case-by-case basis in the event of a traffic violation or accident.

caution, highlighting the challenges in assigning liability when no human driver is directly controlling the vehicle (Duncan, Bonos 2026).

In the event of an accident, liability is apportioned among multiple actors. Pursuant to the German Compulsory Insurance Act (*Pflichtversicherungsgesetz*), the vehicle owner is required to maintain liability insurance for the autonomous vehicle. As with conventional vehicles, the owner's insurer is primarily liable for personal injury and property damage arising from the operation of the autonomous vehicle (Milenković, Sumpor, Tokić 7). Where the accident is attributable to a technical defect in the automated driving system, liability may extend to the manufacturer under the German Product Liability Act. Furthermore, the technical supervisor may incur liability if they fail to intervene appropriately in a critical situation. Finally, where a software defect is established as a contributing factor, the software developer or supplier may also be held liable under the same product liability regime (Milenković, Sumpor, Tokić 7, 2025).

4.5. Reconfiguring Liability: Product Liability and the Role of Software

Legal scholarship reflects a diverse range of positions according to which the rules governing manufacturer liability should likewise apply to damage arising from the use of autonomous vehicles. Such an approach gives concrete effect to the principle of fairness, insofar as it assigns liability to the party that has created and introduced the risk, namely, the manufacturer of the autonomous vehicle. In addition, the imposition of liability upon manufacturers serves an important regulatory preventive, and incentive-based function. By internalizing the costs associated with potential harm, this framework incentivizes manufacturers to enhance the safety and reliability of their products, including through the continuous development, monitoring, and updating of the underlying software systems (Gurney 2013, 271). Liability in the context of autonomous vehicles extends beyond the vehicle manufacturer to include software developers. This is particularly relevant given that vehicle manufacturers often do not produce the underlying software (Gurney 2013, 271). Given that software constitutes a critical component of autonomous vehicle systems, and that defects or malfunctions within such software may directly result in harm to third parties, there are compelling normative grounds for recognizing the liability of software manufacturers for damage arising from the use of autonomous vehicles. Inadequately designed or programmed software may pose significant operational risks; such risks can affect the safety of all road users, due to vulnerabilities or update errors (Sovilj 2024, 42).

In this respect, the increasing integration of AI into autonomous driving systems further complicates the attribution of liability, as the decision-making processes of such systems may be opaque and difficult to reconstruct ex post. Given the technical complexity of these systems, it is to be expected that both the expert community and the judiciary will require a period of adaptation before developing consistent standards for the assessment of liability arising from software-related failures. Consequently, there is a need for clear and precise regulatory frameworks governing the liability of software manufacturers, particularly in light of the divergent interpretations that currently prevail within legal scholarship.[31]

5. CONCLUSION

The rapid evolution of autonomous vehicle technologies represents a profound transformation in the domain of road transport, with far-reaching legal, economic, and societal implications. As this paper has demonstrated, the transition from human-driven to algorithmically controlled vehicles challenges the foundational principles upon which traditional liability regimes have been constructed, particularly those grounded in fault-based liability and the central role of the human driver.

At lower and transitional levels of automation (SAE Levels 2 and 3), existing liability frameworks remain formally applicable, as the human driver continues to bear a residual duty of supervision and intervention. However, the increasing reliance on automated systems exposes the structural limits of such frameworks, particularly in determining the applicable standard of care and the allocation of liability in situations involving partial system control. At higher levels of automation (SAE Levels 4 and 5), where human control is significantly reduced or eliminated, traditional driver-based liability becomes not only inadequate but conceptually unsustainable. While objective liability and the theory of created risk provide a functional mechanism for victim compensation, their continued application without adjustment risks undermining the principles of fairness when imposed on individuals lacking meaningful control. This shift underscores the need to reconceptualize liability beyond the driver-centric paradigm.

[31] For example, Michigan's autonomous vehicle legislation limits the liability of vehicle manufacturers in cases where a separate (software) company produces and integrates autonomous technology into their vehicles (Doskoch 2023, 4).

In response to these developments, a gradual shift toward a system-oriented model of liability is both observable and necessary. This model entails a more nuanced allocation of liability among multiple actors, including vehicle manufacturers, software developers, system operators, and, to a limited extent, vehicle owners. The growing relevance of product liability regimes reflects the recognition that risks are increasingly embedded in the design, programming, and maintenance of complex technological systems rather than in human conduct alone. At the same time, the integration of artificial intelligence introduces additional challenges, particularly with respect to transparency, causation, and evidentiary standards.

Comparative insights, such as those drawn from the German regulatory framework, illustrate the potential for hybrid approaches that combine compulsory insurance schemes with differentiated liability rules. Such models ensure a high level of victim protection while allowing for the subsequent allocation of liability among relevant actors based on fault, defect, or regulatory non-compliance. These developments underscore the importance of maintaining a balance between legal certainty, technological innovation, and the protection of fundamental principles of justice.

From the perspective of the EU, the current regulatory landscape for autonomous vehicles remains fragmented and, in certain respects, insufficiently adapted to their specificities. While existing legal instruments, particularly in the areas of motor vehicle insurance and product liability, provide a foundational framework, they do not fully capture the complexities arising from highly automated and fully autonomous systems. This supports the initial hypothesis that EU liability frameworks are not merely incomplete, but structurally misaligned with the realities of autonomous driving technologies, thereby highlighting the need for a clearer and more precise regulatory framework that adequately reconciles technological innovation with legal accountability.

From the perspective of Serbian national law, there are no significant disputes regarding liability for damage caused by the use of SAE Level 1–3 autonomous vehicles that could not be resolved through the application of the existing rules governing mandatory motor vehicle liability insurance, traffic regulations, and general rules on the liability of the owner or keeper, for damage caused by a dangerous object. This is primarily because the use of any motor vehicle, whether conventional or autonomous, entails comparable risks of property damage, bodily injury, or death affecting road users. Within the framework of the Law on Obligations, special provisions provide enhanced protection to third parties exposed to the risk of damage arising from motor vehicle traffic, and these provisions are equally applicable where autonomous vehicles are involved in a harmful event. Specifically, the rules governing liability for damage caused by dangerous objects, the special regime applicable to damage caused by moving motor vehicles, as well as the manufacturer's liability for defective products, are all regulated under the general framework of the Law on Obligations.[32]

The application of the provisions of the Law on Obligations is not disputed in cases where a SAE Level 1–3 autonomous vehicle is involved in a traffic accident and causes damage, since in such situations it is still presumed that the driver retains control and supervision over the vehicle. However, the issue of liability for damage caused by SAE Levels 4 and 5 autonomous vehicles is considerably more complex and depends on the specific cause of the traffic accident. In this regard, the damage may result from a technical malfunction of the vehicle, defects in the design, software, or algorithm of the autonomous control system, failures in communication between vehicles or between the vehicle and traffic infrastructure, as well as external unlawful interference, such as a hacker attack that compromises the proper functioning of the autonomous system (Mrvić Petrović 2023, 39). Accordingly, in such situations a new cause of traffic accidents emerges – namely, the malfunction or error of the autonomous driving system itself. As a consequence, the traditional basis of liability founded primarily on the conduct of the driver becomes insufficient, and the focus of liability shifts toward the vehicle manufacturer as the entity responsible for the design, development, and placement of the autonomous system on the market. At the same time, given the complexity of the production and distribution chain, the possibility of joint liability of other entities cannot be excluded, including component manufacturers, software suppliers, distributors, and service providers, where it is established that their omission or defect was causally connected to the occurrence of the damage.

Given that software constitutes a key functional element of an autonomous vehicle, it is justified to consider the establishment of a special liability regime for software manufacturers, particularly in situations where the manufacturer of the autonomous driving system is not simultaneously the manufacturer of the vehicle itself. In this regard, existing models of liability for defective products could be expanded to encompass software components, algorithms, and artificial intelligence systems that directly influence decision-making processes during the operation of the vehicle. Such an approach would enable a more precise determination of the causal link between software malfunctions and the resulting damage, while also ensuring a fairer allocation of liability among the entities involved in the development, production, and placement of the autonomous system on the market.

[32] Law on Obligations, Arts. 173–179.

At the same time, the possibility that damage may arise from the construction or technical design of the autonomous vehicle itself, independently of any software malfunction, cannot be excluded (Belanić, Milisavljević 2023, 29). In such circumstances, the issue of concurrence of different grounds of liability arises, namely the parallel application of rules governing liability for defective products, liability for damage caused by dangerous objects, and the general principles of the Law on Obligations. For this reason, future legislative regulation in this field should be based on a clear distinction between liability for hardware defects, software malfunctions, and cybersecurity incidents, while simultaneously providing for the possibility of joint and several liability of multiple entities where the damage results from interconnected causes.

In the authors' view, the most appropriate approach for Serbian law would be a combined liability model. Such a model should preserve the existing regime of strict liability of the vehicle owner or operator toward third parties in cases involving SAE Level 1–3 autonomous vehicles, where human supervision and control over the vehicle are still present. However, with regard to SAE Level 4 and 5 autonomous vehicles, a special regime of producer liability should be introduced, applicable to manufacturers of autonomous vehicles and software developers in situations where the damage results from defects in autonomous driving systems, algorithms, or cybersecurity failures. In addition, consideration should be given to the introduction of mandatory insurance covering operators and manufacturers of highly automated vehicles (SAE Levels 4 and 5).

Accordingly, the reconceptualization of liability in the context of autonomous vehicles should not be understood as a complete departure from existing legal principles, but rather as their gradual evolution. A balanced approach, combining elements of strict liability, product liability, and mandatory insurance, appears best suited to address the multifaceted risks associated with automated driving. Such an approach must remain sufficiently flexible to accommodate future technological developments while preserving the fundamental objectives of liability law: compensation, deterrence, and fairness.

REFERENCES

[1] ADAS. 2024. SAE Level 2 – Partial Driving Automation. April 2024. *https://www.aaa-adas.us/sae/level-two*, last visited May 28, 2026.

[2] Anderson, James M., Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola. 2016. *Autonomous Vehicle Technology – A Guide for Policymakers*. Santa Monica: RAND Corporation.

[3] Ba, Zhuo, Ziyu Zhao, Bokang Zhang. 12/2025. Liability for Autonomous Vehicle Torts: Who Should Be Held Responsible? *World Electric Vehicle Journal* 16: 1–21.

[4] Belanić, Loris, Eric Milisavljević. 2023. Autonomna vozila i odgovornost za štetu [Autonomous vehicle and liability for damages]. *Hrvatski časopis za osiguranje* 8: 11–31.

[5] Butilă, Eugen Valentin, Gheorghe-Daniel Voinea, Răzvan Gabriel Boboc, Grigore Ambrosi. 2/2026. Autonomous Vehicles in the Traffic Ecosystem: A Comprehensive Review of Integration, Impacts, and Policy Implications. *Vehicles* 41: 1–37.

[6] Chatzipanagiotis, Michael, George Leloudas. 1/2020. Automated Vehicles and Third-Party Liability: A European Perspective. *Journal of Law, Technology & Policy* 2020: 109–199.

[7] De Bruyne, Jan, Jarich Werbrouck. 5/2018. Merging Self-Driving Cars with the Law. *Computer Law & Security Review* 34: 1150–1153.

[8] Doskoch, Julia. 2023. "Your Honor, the Car Crashed Itself": Navigating Autonomous Vehicles Liability in an Age of Innovation. *Boston College Intellectual Property & Technology Forum Journal* 2023: 1–13.

[9] Dumančić, Kosjenka, Dominik Vuletić. 2025. Liability for Damages Caused by Autonomous Driving Vehicles from the EU Law Perspective. *EU and Comparative Law Issues and Challenges Series (ECLIC)* 9: 64–76.

[10] Duncan, Ian, Lina Bonos. 2026. Waymo robotaxi hits child at school drop-off, triggering safety inquiry. *The Washington Post*, January 29.

[11] Ebers, Martin. 2022. *Civil Liability for Autonomous Vehicles in Germany*. *https://ssrn.com/abstract=4027594*, last visited May 28, 2026.

[12] Fernandez-Llorca David. 2021. From driving automation systems to autonomous vehicles: clarifying the terminology. *arXiv preprint arXiv* 2103.10844.

[13] Frisman, Paul. 2012. California's Self-Driving Vehicle Law. *OLR Research Report* 2012-R-0456. October 16. *https://www.cga.ct.gov/2012/rpt/pdf/2012-R-0456.PDF*, last visited May 28, 2026.

[14] Garthwaite, Josie. 2012. Google Gets First Driverless Car License: Strings Attached. *National Geographic*. May 9. *https://www.nationalgeographic.com/environment/article/google-gets-first-driverless-car-license-strings-attached*, last visited May 28, 2026.

[15] Gurney, K. Jeffrey. 2/2013. Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles. *Journal of Law, Technology & Policy* 2013: 247–277.

[16] Hacker, Philipp. 2023. The European AI Liability Directives – Critique of a Half-Hearted Approach and Lessons for the Future. *Computer Law & Security Review* 51: 1–42.

[17] Janković, Svetislav, Ranko Sovilj, Sanja Zlatanović. 1/2025. Društveni i pravni položaj vozača-migranata u javnom drumskom saobraćaju. *Stanovništvo* 63: 73–92.

[18] Jones Day. 2021. Autonomous Vehicles: Legal and Regulatory Developments in the United States. White paper. *Jones Day*. May. *https://www.jonesday.com/-/media/files/publications/2021/05/autonomous-vehicles-legal-and-regulatory-developments-in-the-us/files/autonomous-vehicles-legal-and-regulatory-developme/fileattachment/autonomous-vehicles-legal-and-regulatory-developm.pdf*, last visited May 28, 2026.

[19] Kajtez, Miloš N. 2014. Autonomna vozila: početak i primena robotizovanih vozila u saobraćaju (Autonomous Vehicles: The Beginning and the Application of Robotic Vehicles in Traffic). *eRAF Journal on Computing* 6: 15–35.

[20] Karanikić Mirić, Marija. 2016. Prilog razumevanju pravila o solidarnoj odgovornosti imalaca motornih vozila (čl. 178 st. 4 ZOO) (Joint and Several Liability of the Proprietors of Motor Vehicles in Road and Traffic Accidents). 188–201 in *Perspektive implementacije evropskih standarda u pravni sistem Srbije (Perspectives of the Implementation of European Standards in the Legal System of Serbia)*, edited by Stevan Lilić. Belgrade: Pravni fakultet Univerziteta u Beogradu.

[21] Karanikić Mirić, Marija. 2017. General Clause on Strict Liability in Comparative Perspective. 345–356 in *Law and Transition*, edited by Bojan Milisavljević, Tatjana Jevremović Petrović, Miloš Živković. Belgrade: Pravni fakultet Univerziteta u Beogradu.

[22] Karkafiris, Michael. 2017. Audi Details New A8's AI Traffic Jam Pilot, First Level 3 Autonomous System on the Market. *Carscoops*. September 7. *https://www.carscoops.com/2017/09/audi-details-new-a8s-ai-traffic-jam/*, last visited May 28, 2026.

[23] Kolodny, Lora, 2025. Tesla must pay portion of $329 million in damages after fatal Autopilot crash, jury says. *CNBC*. August 1. *https://www.cnbc.com/2025/08/01/tesla-must-pay-329-million-in-damages-in-fatal-autopilot-case.html*, last visited May 28, 2026.

[24] Kordić, Biljana, Mira Rosić, Tanja Arsić, Dejan Milanović. 2017. Autonomna vozila i njihov uticaj na bezbednost saobraćaja (Autonomous Vehicles and Their Impact on Road Safety). 229–235 in *Road Safety in Local Community: Conference Proceedings*, edited by Krsto Lipovac, Dragan Jovanović, Miladin Nešić. Novi Sad: Faculty of Technical Sciences.

[25] Leiman, Tania. 2/2021. Law and tech collide: foreseeability, reasonableness and advanced driver assistance systems. *Policy and Society* 40: 250–271.

[26] Marchant, E. Gary, Rachel A. Lindor. 4/2012. The Coming Collision Between Autonomous Vehicles and the Liability System. *Santa Clara Law Review* 52: 1321–1340.

[27] Mehlhorn, Marcel Aguirre, Andreas Richter, Yuri A. W. Shardt. 2/2023. Ruling the Operational Boundaries: A Survey on Operational Design Domains of Autonomous Driving System. IFAC PapersOnLine 56: 2202–2213.

[28] Mendiboure, Leo, Mohamed Lamine Benzagouta, Dominique Gruyer, Tidiane Sylla, Morayo Adedjouma, Abdelmename Hedhli. 2023. Operational Design Domain for Automated Driving Systems: Taxonomy Definition and Application. *Conference: 2023 IEEE Intelligent Vehicles Symposium* IV: 1–6.

[29] Mercedes Benz. 2023. Certification for SAE Level 3 system for U.S. market. *Mercedes Benz Group*. January 26. *https://group.mercedes-benz.com/technology/autonomous-driving/driving/drive-pilot-nevada.html*, last visited May 28, 2026.

[30] Milenković, Melita, Davor Sumpor, Sandro Tokić. 1/2025. Legal and Safety Aspects of the Application of Automated and Autonomous Vehicles in the Republic of Croatia. *World Electric Vehicle Journal* 16: 34.

[31] Mrvić Petrović, Nataša. 2023. Odgovornost za štetu nastalu upotrebom automatizovanog vozila (Liability for Damage Caused by the Use of an Automated Vehicles). 29–50 in *Prouzrokovanje štete, naknada štete i osiguranje* (*Causation of Damage, Damage Compensation and Insurance*), edited by Zdravko Petrović, Vladimir Čolović, Dragan Obradović. Belgrade: Institut za uporedno pravo.

[32] Mudrić, Mihael. 2024. Automatizirana vozila i pravo – nered na cesti (2.). *Bug.hr*. February 13. *https://www.bug.hr/automobili/automatizirana-vozila-i-pravo-nered-na-cesti-2–38352*, last visited May 28, 2026.

[33] Murphy, Robin R. 2000. *Introduction to AI Robotics*. Cambridge, Massachusetts: MIT Press.

[34] Pellegatta, Stefano. 2019. Autonomous Driving and Civil Liability: The Italian Perspective. *Rivista di Diritto Dell' Economia, dei Transporti e dell' Ambiente* 17: 135–163.

[35] Radišić, Jakov. 1976. *Imovinska odgovornost za štetu izazvanu motornim vozilom* (Civil liability for damage caused by a motor vehicle). Belgrade: Institut društvenih nauka – Centar za pravna istraživanja.

[36] Razdan, Rahul, Raivo Sell, M. Ilhan Akbas, Mahesh Menase. 22/2025. Perspectives on Safety for Autonomous Vehicles. *Electronics* 14: 4500.

[37] Sovilj, Ranko. 2024. Odgovornost za štetu nastalu upotrebom autonomnih vozila (Liability for Damage Caused by the Use of Autonomous Vehicles). 38–43 in *Knjiga sažetaka: Srbija i reformisanje instituta odgovornosti 7* (*Book of summaries: Serbia and reforming the institute of liability 7*), edited by Hajrija Mujović. Belgrade: Institut društvenih nauka; Novi Sad: Advokatska komora Vojvodine.

[38] Toman, Michal. 2023. AI Liability Directive – first impressions. 713–719 in *Naděje právní vědy 2022*. Pilsen: University of West Bohemia.

[39] UNECE. 2024. *Guidelines and recommendations for Automated Driving System safety requirements, assessments and test methods to inform regulatory development*. *https://unece.org/sites/default/files/2024–11/ECE-TRANS-WP.29–2024–39e.pdf*, last visited May 28, 2026.

[40] Uzair, Muhammad. 2/2021. Who Is Liable When a Driverless Car Crashes? *World Electric Vehicle Journal* 12: 62.

[41] Widen, H. William, Marilyn C. Wolf. 2025. Law as a Design Consideration for Automated Vehicles Suitable to Transport Intoxicated Persons. 1–7 in *Proceedings of the 2025 Design, Automation & Test in Europe Conference (DATE)*, edited by Aida Todri-Sanial and Theo Theocharides. Lyon: IEEE.

[42] Yang, Yichuan, Zongyu Song. 1/2025. The public perception and adaptability of laws and regulations of autonomous driving vehicles. *Humanities & Social Sciences Communications* 12: 1–12.

Article history:
Received: 22. 4. 2026.
Accepted: 27. 5. 2026.