Prevention of Criminal Offenses in the Field of Road Safety

Nataliia Riabykh [1], Ihor Pyroha [2], Oleksandr Panasiuk [3] Yulia Pundor [4] Iryna Shcherbatiuk [5], Nataliia Chechel [6]

[1] Department of Law, Lutsk National Technical University, Lutsk, Ukraine
[2] Department of Constitutional Law and Comparative Law, Uzhhorod National University, Uzhhorod, Ukraine
[3] Department of Law, The Volyn Viacheslav Lypynskyi Institute, Interregional Academy of Personnel Management, Lutsk, Ukraine
[4] Department of Law, Faculty of Business and Law, Lutsk National Technical University, Lutsk, Ukraine
[5] Department of Law, Volyn Institute named after Vyacheslav Lipinski, Lutsk, Ukraine
[6] Department of Criminal Justice and Law Enforcement, Lesya Ukrainka Volyn National University, Lutsk, Ukraine

The article is devoted to a comprehensive study of the criminal law and criminological principles of ensuring road safety in the context of increasing transport mobility and the complexity of the road environment. It reveals the role of international and European standards, including EU approaches, WHO guidelines and the "Safe System" concept, in shaping an effective model of combating transport crime. It is shown that the effectiveness of criminal law measures depends on their integration with preventive, infrastructural and organizational mechanisms, as well as on the proper quality of evidence and coordination between competent authorities. Special attention is paid to criminological factors underlying road safety offenses, emphasizing risk-oriented behavior of young drivers, personal characteristics, fatigue, socio-economic conditions and infrastructure deficiencies. The conclusion highlights the need to harmonize national legislation with European approaches, enhance preventive policy, implement digital risk-monitoring technologies and strengthen interagency cooperation to improve the prevention of criminal offenses in the field of road traffic.

Keywords: road safety, criminal offenses, prevention, criminological factors, international standards, risk-oriented behavior, road infrastructure.

1. Introduction

Road safety is one of the key elements of public safety and forms an important component of the legal order of modern states. The intensive development of transport infrastructure, the growth of population mobility and the complication of the road environment lead to an increase in the number of risks associated with the movement of vehicles. In these conditions, there is a need for an in-depth study of the mechanisms of criminal law response to socially dangerous acts that encroach on the life, health and safety of road users. Effective prevention of such offenses is a priority of the legislative and law enforcement policy of the state.

Criminal offenses in the field of road safety constitute a complex and multidimensional legal phenomenon, covering both the features of the individual behavior of road users and systemic shortcomings in the infrastructural, technical and organizational support of the road system. Their latency, reproducibility and high level of social danger determine the relevance of scientific analysis of criminological factors and institutional mechanisms of counteraction. It is also important to identify the relationship between legislative regulation, prevention policy and real indicators of accidents and crime.

The system of criminal law and criminological means of preventing offenses that occur in conditions of increasing transport dynamics and intensive use of digital technologies requires special attention. The effectiveness of legal interventions largely depends on the quality of interaction between the police, courts, law enforcement agencies, as well as on the level of legal awareness of

road users. In modern conditions, prevention should be based on scientifically substantiated methods of risk analysis, improved mechanisms of control and management of behavior and systemic state policy aimed at minimizing criminogenic factors.

The purpose of the article is a comprehensive study of international and European standards of criminal law protection of road safety, identification of criminological factors that determine crime in this area, as well as assessment of the effectiveness of current legislation and institutional prevention measures. The generalization of theoretical provisions and practical experience allows us to form scientifically based approaches to improving criminal law policy and develop proposals for increasing the effectiveness of the system for preventing criminal offenses in the field of road safety.

2. Methodology

The research methodology is based on the use of a complex of general scientific and special legal methods that allow a comprehensive description of criminal offenses in the field of road safety and an assessment of the effectiveness of institutional mechanisms for their prevention. The dialectical method provided an analysis of the development of legal regulation in connection with social changes and the evolution of the transport system. The formal-legal method was used to clarify the content of regulatory legal acts, determine the features of the legal status of subjects of preventive activity and distinguish the types of criminal offenses. The comparative-legal method made it possible to compare domestic and foreign approaches to the prevention of transport crimes, identify differences in legal response models and identify effective practices. The empirical basis is provided by statistical data on the level of accidents and criminal activity in the field of road traffic, analytical reports of authorized bodies and the results of generalization of law enforcement practice. The content analysis method was used to identify trends in court decisions and acts of law enforcement agencies, and the system-structural approach was used to establish the place of the police, courts, law enforcement agencies and other institutions in the prevention mechanism. Such methodological tools ensured the comprehensiveness, objectivity and integrity of the study, and also made it possible to form scientifically based conclusions on the improvement of criminal law and organizational measures to prevent road safety offenses.

3. Theoretical and legal principles of preventing criminal offenses in the field of road safety

International standards and European approaches to criminal law protection of road safety form a multi-component system that combines legal regulation, criminological analysis and preventive practices aimed at reducing the level of road traffic injuries. In this context, the World Health Organization consistently emphasizes the need for comprehensive strategies where criminal law and criminological tools are integrated to increase the effectiveness of the overall road safety policy (Peden et al., 2004).

The European approach is characterized by the desire to harmonize the norms that regulate the response to both administrative and criminal offenses in the field of road safety. The documents of the European Union reflect the need to form uniform standards for responding to road traffic crimes, with an emphasis on preventive activities, systematic supervision and prevention of recidivism (EU-Directive).

In international practice, the criminal-legal response to road crimes is often considered as a last resort, applicable in cases of high public danger. However, criminology shows that it is preventive measures – from risk-based assessments of driver behavior to offender rehabilitation programs – that ensure a long-term reduction in criminal offenses in this area. Thus, the effectiveness of criminalizing dangerous behaviors is largely determined by the presence of accompanying criminological interventions.

The European road safety doctrine also highlights the principle of proportionality and the need for legal guarantees during criminal prosecution. In this regard, criminological research focuses on determining under what conditions criminal-legal measures are justified, and when administrative or

preventive instruments aimed at correcting behavior without criminal repression are more effective.

Of particular importance in international standards is the concept of "Safe System" and the Vision Zero strategy, which integrate criminal-legal, engineering and preventive measures. From a criminological point of view, such approaches allow shifting the emphasis from punishment to prevention, in particular by eliminating risk factors, improving road infrastructure safety and minimizing driver behavioral deviations.

European mechanisms for cross-border surveillance of road offenses emphasize that effective prevention of criminal acts on the roads requires institutional coordination and rapid exchange of information between states. In this regard, criminological analysis methods allow identifying high-risk groups, assessing the risks of recidivism and optimizing preventive strategies.

The evidentiary component is key to ensuring criminal liability in the field of road safety. International standards emphasize the importance of high-quality evidence collection, forensic examination and interdisciplinary coordination. At the same time, the criminological component focuses on identifying the causes and motives of offenses, which allows for the formation of effective preventive programs aimed at minimizing such risks in the future.

A comparison of international practices shows different intensity of use of criminal sanctions: some countries strengthen criminal liability for repeated and serious violations, while others emphasize preventive work - educational programs, speed control, penalty points systems. Criminological studies prove that the best results are obtained by combining these approaches.

The problem of alcohol and drug intoxication among drivers remains one of the most critical factors of road crime. International organizations point to the need to combine strict criminal law sanctions with active prevention: regular testing, educational campaigns, addiction treatment programs and criminological monitoring of risk groups.

In the process of European integration, a state that is reforming its legislation is faced with the need to harmonize not only the substantive norms of criminal law, but also approaches to prevention, assessment of criminogenic factors, as well as programs for the resocialization of offenders. It is criminological analysis that allows adapting European standards to national conditions and increasing the effectiveness of preventive activities.

The digitalization of transport, automated control systems, and the widespread use of telematics create new challenges for criminal law regulation. At the same time, they open up significant opportunities for criminological forecasting and preventive analytics, which makes it possible to identify risks in a timely manner and prevent road traffic offenses.

As a result, international and European standards indicate the feasibility of integrating criminal law, forensics, and criminological measures into a single prevention system. The most effective models are those in which law, infrastructure, prevention, and international cooperation work in conjunction, ensuring a sustainable reduction in criminal offenses in the field of road traffic safety.

4. Analysis of criminological factors that determine road traffic crime

The human factor remains the leading criminological determinant, which significantly increases the likelihood of offenses and serious road traffic accidents. In particular, risk-oriented behavior of young drivers – such as speeding, aggressive driving or substance use – reaches extreme levels: in some studies, more than 90% of participants reported engaging in some form of risky driving, which directly correlates with the frequency of road traffic accidents (hereinafter referred to as accidents) [1].

Another significant aspect is the personality traits of drivers. Researchers have noted that impulsivity, sensation-seeking, reward seeking, and sensitivity to punishment/reward are directly correlated with aggressive driving and increased involvement in violations [2].

A study by Hatfield and Fernandes (2009) found that young drivers have significantly higher risk-propensity than older drivers, and that risky driving motives (experience-seeking, excitement, risk-aversion, "letting off steam," etc.) are associated with more frequent violations [3].

In addition, the stability of risky behavior over time is an important criminological indicator. For example, data from the DRIVE longitudinal study show that new drivers who demonstrated high

levels of risky driving at ages 17–24 maintained their elevated risk levels 13 years later, suggesting a long-term criminal predisposition [4].

A systems approach, including the use of the Haddon matrix, allows for the analysis of the interaction of human, transport and environmental factors in terms of risk. Factors in the categories of “host”, “agent” and “environment” have been found to significantly influence the severity of injuries, and their interaction is key to prevention [5].

Technically, infrastructure deficiencies – such as poor road design, inadequate lighting or unreliable barriers – act as amplifiers of the negative impact of behavioral disorders, increasing the risk and severity of road accidents. Analysis using the Haddon matrix allows us to identify precisely such relationships, which are critical for the development of preventive strategies.

The factor of driver fatigue and drowsiness also has criminological significance. Experimental data show that fatigue while driving, especially in the dark, leads to errors similar to behavior under the influence of alcohol, which significantly increases the risk of accidents. In a group of professional drivers (for example, commercial vehicle drivers), chronic fatigue, excessive working hours and irregular breaks create an environment in which the likelihood of committing a violation, and sometimes a criminal act, increases significantly.

Equally important is the socio-economic context. Low income, limited access to education or an insufficient transport culture can stimulate deviant behavior while driving. Although specific criminological studies in this direction are limited, road safety data confirm a direct relationship between socio-economic conditions and accident rates.

In a global context, especially in developing countries, the human factor often prevails over technical factors. For example, research in Ethiopia has shown that the lack of safety equipment (helmets), alcohol, and poor road lighting are correlated with increased severity of injuries in road crashes [6]. These findings point to the need for a criminological approach that combines repression with prevention: educational programs, social interventions, technological solutions, and systemic legislative changes.

Personal characteristics of young drivers, such as high risk-taking, can be a guide for targeted prevention programs: mentoring, training, behavioral assessment - all of which can help reduce the risk of serious offenses.

It is also important to strengthen data collection: criminological studies should be reinforced with high-quality epidemiological and trauma data to more clearly model risks and develop effective prevention strategies.

The technological perspective is no less promising: the implementation of fatigue monitoring systems (for example, sensors or algorithms for recognizing drowsiness) can become an integral part of criminological prevention, especially among drivers with high risk potential.

Therefore, the analysis of criminological factors of road traffic crime requires a multidimensional, multisectoral strategy: legislative, educational, social, infrastructural and technological activities must be accompanied by criminal law measures in order to effectively reduce both the frequency of violations and the severity of their consequences.

5. Modern criminal law and criminological mechanisms for preventing road safety offenses

The effectiveness of current criminal legislation in the field of road safety is assessed through the prism of general and special prevention, as well as the empirical effectiveness of norms in reducing mortality, injuries and recidivism; modern reviews prove that the best results are achieved where criminal law prohibitions are integrated with systemic supervision and engineering and organizational measures, while "isolated" criminalization rarely provides a sustainable effect without proper detection, inevitability of punishment and resocialization programs. In the Ukrainian context, articles on road safety violations (in particular, drunk driving, causing a traffic accident with consequences) perform a symbolic and protective function, but enforcement and recidivism rates indicate the limitations of a purely repressive response without increasing the likelihood of detection, standardization of practice and targeted correctional programs for offenders. Comparative data on

integrated “Vision Zero” programs demonstrate that combining criminal law sanctions with targeted infrastructure, automated speed enforcement and organizational changes reduces the number of deaths and injuries much more noticeably than reactively increasing penalties; for example, in London, KSI has been significantly reduced in zones with cameras and local traffic calming, highlighting the key role of the inevitability of control, not just the severity of the rules [7]. For criminal law, this means that regulations achieve their preventive effects primarily through interaction with evidence-based supervision and environmental design, rather than through nominal increases in sanctions.

Meta-analyses and knowledge gap maps note a skewed evidence base in favor of high-income countries and a paucity of research in developing countries, making it difficult to extrapolate the effects of criminal law models; however, even existing reviews emphasize that legal and institutional measures, combined with engineering and educational ones, have synergistic effects on safety, while “single” criminal law interventions often measure intermediate rather than final outcomes. This suggests a need to revise the objectives of evaluating the effectiveness of criminal laws: the primary criteria should relate to changes in crash rates, KSI, and recidivism, rather than just the number of proceedings or convictions [8].

Criminal liability for pedestrians and other vulnerable risk groups is shown to be more effective where legislation is supported by intensive and targeted enforcement at intersections, in school zones and near senior centers; systematic reviews show that legislation and its enforcement, combined with infrastructure changes, reduce pedestrian injuries, confirming the role of legal tools as part of a wider package. This allows the effectiveness of criminal law to be assessed not as a stand-alone variable, but as a component of an integrated ecosystem of road risk management [7]. In the context of general and specific prevention, it is not so much the size of sanctions that is important, but the perceived inevitability and fairness of punishment; modern research on road behavior, drawing on the development of deterrence theory, shows that integrated models of formal and informal sanctions are better predictors of compliance than an emphasis on severity alone. Therefore, the assessment of current criminal norms should include indicators of detectability of offenses, consistency of sentencing practices and trust in law enforcement as determinants of preventive effect [9].

The issue of recidivism among offenders in the field of BDR is directly related to the effectiveness of criminal law measures: reviews indicate significant “windows of opportunity” for behavior correction after the first offense, but the body of research remains fragmentary and often focuses on the alcohol factor; this poses the task of legislators to consolidate and scale up evidence-based programs in the system of execution of sentences. Data from large samples show that psychoeducational interventions in the system of execution of sentences for traffic safety offenders significantly reduce recidivism, especially when combined with psychotherapeutic components, which argues for the need for their normative institutionalization [10].

The practice of large city programs demonstrates that the legal category of inevitability of punishment acquires real meaning through automated control systems that reinforce criminal law norms and reduce speed and KSI (Killed and Seriously Injured) locally; reports show significant reductions in dangerous behavior near cameras and at priority locations, which at the same time reduces the “cost” of proving a crime and increases the procedural quality of evidence [7]. In such a paradigm, criminal law becomes the “top level” of the deterrence pyramid, while basic changes in detection and engineering create a context in which legal prohibitions actually reduce the chances of a tort. Our research indicates the need for unification and coordination of preventive measures across all law enforcement actors, as fragmentation of programs and uneven practices reduce the cumulative preventive effect of criminal law norms; Strengthening grant and inter-institutional mechanisms can ensure the sustainability of evidence-based approaches. For the legislator, this means the importance of establishing a procedural infrastructure for enforcement (risk analysis, priority locations, technical controls), without which criminal law provisions remain “weakly implemented”.

The European Road Safety Policy 2021-2030 establishes a long-term vision of zero fatalities, where criminal law instruments are seen as part of a broader multi-layered response; EU analytical handbooks on road enforcement stress the centrality of high-quality enforcement, which increases the

perception of inevitability and provides an evidence base for prosecutions, which directly strengthens prevention [11; 12]. This sets the standard for evaluation: the effectiveness of criminal regulations should be measured through indicators of injury, speeding discipline, recidivism and coverage of automated supervision, and not only by the "severity" of sanctions (European Commission, 2023).

In view of the above, the key criteria for assessing the effectiveness of current criminal legislation in the analyzed area should include: reducing the KSI in priority areas, reducing recidivism among those convicted of road traffic offenses, increasing the detectability of offenses, unifying law enforcement practices and institutionalizing psychoeducational programs in the system of execution of sentences; these are the indicators that correlate with the best international results. In conclusion, criminal law regulations are a necessary but not sufficient condition for safety: their preventive "power" is realized through linking with technological supervision, engineering changes and programs for correcting the behavior of offenders [8].

Finally, for a correct academic measurement of effectiveness, it is necessary to avoid substitution of goals: the number of criminal proceedings or convictions is not an independent indicator of safety, while validated results - a decrease in mortality/injury, a stable decrease in speed and a steady drop in recidivism - reflect precisely the preventive effect of criminal norms in combination with other tools; existing reviews and city programs confirm this logic, setting guidelines for further codification and enforcement. Therefore, the evaluation of current criminal legislation in the field of road safety should be integrated, result-oriented and based on standardized, comparable metrics that are directly related to the protection of the life and health of road users.

6. Institutional mechanisms of prevention: the activities of the police, courts, law enforcement agencies.

Institutional mechanisms of prevention in the field of road safety are formed as an interaction of the police, courts and other law enforcement agencies, where the key factor of deterrence is not the severity of sanctions, but the perceived inevitability of detection and punishment, ensured by the proper organization of supervision, transparent procedural practices and consistent judicial enforcement [8; 13]. Systematic reviews of the effectiveness of road interventions confirm that legal and institutional measures, in particular targeted policing and judicial enforcement, produce sustainable results when integrated into a Safe System approach and supported by data and automated control [8].

The activities of the police as an institutional core of prevention have a dual vector: a focused presence in "hot spots" of risk and an institutional design of supervision that maximizes the detection of violations during critical periods, with studies showing that targeted, data-driven patterns of patrols and inspections lead to a noticeable preventive effect compared to routine, unfocused activity [14]. Automated means of supervision (fixed speed cameras, red light control) have proven their ability to increase the inevitability of control at a lower cost of police-driver contact, which is especially important for preventing conflict interactions and for ensuring a high-quality evidence base in court; generalization of the results indicates double-digit reductions in accidents and injuries in areas with cameras [15]. Additionally, quasi-experimental evaluations of fixed cameras have shown an increase in speeding discipline and a decrease in KSI near locations, while the effect diminishes with distance, highlighting the importance of network planning and public communication of checkpoints [16].

Procedural fairness and police visibility directly influence collective community efficacy and willingness to comply; multilevel models demonstrate that fair treatment and transparent communication increase trust and shared willingness to maintain order, indirectly reducing risky road behavior. This implies that the institutional design of policing should combine technical controls with communication strategies that reduce "controlled resistance" and enhance voluntary compliance [17].

The role of the courts is to ensure predictability and proportionality of sanctions, which together with speed of proceedings form key parameters of deterrence; analytical guides on the use of fines emphasize the four dimensions of deterrence theory – inevitability, severity, speed and publicity – and show that institutional bottlenecks in the judicial chain neutralize police efforts. The practices of immediate (temporary) license withdrawal or roadside suspension demonstrate a stronger deterrent

effect due to the speed and clarity of consequences, which should be reflected in procedural standards and information campaigns of judicial authorities. At the EU policy level, thematic reports on road traffic enforcement set standards for police and courts: targeted planning of "dose" of supervision, randomised alcohol/drug checks at critical times, continuous speed monitoring, as well as integrated information systems for evidence and analytics that improve the quality of criminal prosecutions [12]. The updated Vision Zero achievement audits emphasize that coordination between agencies and common metrics (KSI, surveillance coverage, recidivism) are a condition for the effectiveness of the entire institutional connection "police-prosecutor's office-court" [12].

Institutional reforms of law enforcement coordination, the construction of common data platforms and a clear separation of powers in road safety enforcement, which are mentioned in the reports on the rule of law and security, are relevant for Ukraine; these areas allow transforming police operations into evidence-based, with predictable judicial outcomes. In parallel, the creation and operationalization of regional road safety observatories (EaP RSO) supports the institutional capacity of law enforcement agencies through data unification, risk analytics and harmonization with European practice [18].

Empirical generalizations from countries with different income levels show that policing and enforcement interventions have the greatest impact on reducing injuries when they are embedded in comprehensive speed management and targeted programs that reduce behavioral risk factors; this reinforces the rationale for institutional investments in surveillance and judicial capacity. At the same time, research indicates a chronic underestimation of infrastructural and post-crash components, which require interagency coordination with emergency services and hospitals as part of the broader preventive mission of law enforcement institutions [19].

A separate line of evidence concerns the "dose" of surveillance: systematic reviews show that intensive and long-term operations, supported by communication of the risk of exposure, provide a more sustainable reduction in dangerous behaviors than short-term campaigns; key are time windows, geographic targeting, and the number of tests/fines as management indicators [20]. For courts, this translates into the need for a fast, consistent review process with minimal delay between violation and sanction to maintain a preventive "signal" in the behavioral economy of the offender.

Automation of enforcement empowers not only the police but also the courts: digital chains of evidence generated by speed cameras and public transport lane monitoring systems reduce procedural waste, standardize the evidentiary base, and reduce the divergence of judicial decisions, which further strengthens the preventive effect through predictability. The experience of jurisdictions where the suspension of automatic cameras led to a resurgence in crash rates strengthens the argument for institutionalizing automated surveillance as part of a sustainable preventive infrastructure [21].

The interaction of the police with the legislative process also has a preventive value: the police, as a carrier of risk expertise, must participate in the development of norms in order to ensure that real risks are "covered" by law and to avoid gaps that cannot be compensated for by purely operational measures; this emphasizes the inextricable link between police efficiency and the quality of the legal environment and the practice of its application by the courts. In this sense, institutional efficiency is measured not only by the number of violations detected, but also by the correspondence of the risk profile of the roads to regulatory structures and the stability of judicial practice.

Ultimately, institutional prevention mechanisms work best in conjunction: the police ensure a high probability of detection and high-quality primary evidence; the prosecutor's office and the courts - timeliness, proportionality and consistency of sanctions; interdepartmental structures - analytics, standards and coordination, which together form a common preventive "signal" for all road users. The institutionalization of these practices through policies, data, technology, and procedural standards creates a conditional "ecosystem of inevitability" in which legal prescriptions gain real behavioral force and reduce the overall burden of road traffic injuries.

7. Using modern technologies: automated control, data analytics, ITS systems in combating criminal offenses in the field of road safety

Modern technologies in the field of road safety form the institutional infrastructure of the

inevitability of detection and punishment, where automated control, data analytics and intelligent transport systems (ITS) enhance the preventive effect of criminal law norms through constant supervision, high-quality evidence and reduction of the human factor in law enforcement. Empirical reviews and thematic reports of the EU confirm that automated recording of speeding and driving at a prohibitory signal significantly reduces the number of accidents and injuries, especially if the locations are correctly selected and combined with other elements of the Safe System (European Commission, 2023).

Automatic speed cameras show on average double-digit reductions in collisions at their locations, with the effect diminishing with distance, requiring network planning and a combination of fixed, mobile and sectional enforcement systems to maintain a preventive signal in space (Trendline KPI, 2024). Combined speed/red light complexes have been shown to have greater safety benefits than individual RLCs, with significant reductions in side collisions and injuries, consistent with the role of speed as a fundamental risk factor at intersections [22]. Meta-analyses of the effects of RLCs show a reduction in t-bone collisions and injuries, although there may be an increase in minor rear-end collisions, which should be mitigated by measures to reduce approach speeds and optimise signal cycles, which overall increases the net preventive effect at network nodes. Long-term reviews also highlight that removing or suspending cameras leads to a return to dangerous behaviour, underscoring the need for a stable institutionalisation of automated enforcement [22].

Quasi-experimental studies of fixed cameras in urban networks have shown a reduction in average speeds, offender rates and KSI near their locations, which increases the evidentiary capacity of law enforcement and facilitates further prosecution in high-stakes cases [16]. In our view, updated assessment methods allow us to better separate the effects of enforcement systems from regression to the mean, making causality inferences more robust for prevention policies [16].

Data analytics in road safety is moving from descriptive to predictive and prescriptive: enforcement KPIs include volume and “dose” of surveillance, time windows, spatial targeting, and proportion of detected offenses, enabling risk management at the micro-location level and adjusting police and judicial tactics [23]. Evidence syntheses for law enforcement recommend increasing effectiveness through sustained, repetitive operations with public communication of the risk of detection, as perceived inevitability determines overall prevention.

Intelligent transport systems (ITS) integrate detectors, video analytics, V2X communication, and adaptive regulation, which enhances coordination between road users and reduces conflict at nodes, while creating digital chains of evidence for serious accident proceedings. Evidence that IT solutions in intersection management and signal enforcement reduce conflicts and injuries through increased discipline correlates with higher compliance rates without the need for constant police-driver contact.

Integrated road analytics platforms such as national accident databases with mobile data entry by police and hospitals provide registration of coordinates, causes and factors, which allows to identify “hot spots”, build control priorities and assess the impact of law enforcement interventions in real time. Such data architecture supports evidence-based policy, accelerates administrative and judicial processes and reduces procedural losses in criminal proceedings related to road crimes.

From the point of view of criminal law prevention, automation of supervision minimizes selectivity and subjectivity, unifies the evidence base and reduces unevenness of judicial practice, which increases the perception of justice and strengthens general and specific prevention. Interoperability of systems (police, local governments, medical services) within the framework of ITS allows to simultaneously improve evidence of guilt and organize post-crash routes, reducing the severity of consequences and social damage.

For the Ukrainian context, the priorities are scaling up automated speed enforcement, implementing sectional enforcement, integrating with European KPI standards, and developing unified analytical platforms for law enforcement agencies, as recommended by European institutions in connection with law enforcement reform and the rule of law [22]. Parallel consolidation of procedural standards for the admissibility of digital evidence and shortening the time between offense and sanction will strengthen the preventive signal and reduce the recurrence of risky behavior [22].

Finally, the impact of modern technologies depends on communication design and transparency: public maps of control locations, feedback on results, and regular reporting on unified metrics build trust and willingness to voluntarily comply, making technological systems not only punitive, but also behaviorally oriented tools of prevention. It is the combination of automated control, deep analytics, and clear rules within the framework of ITS that creates the conditions for a sustainable reduction in road accidents and serious consequences and gives criminal law real preventive effectiveness in the field of road safety.

8. Conclusions

Summing up international and European approaches to criminal law protection of road safety, we can state the gradual establishment of an integrative model of prevention, which combines legal, criminological, engineering, information and organizational tools. The European doctrine emphasizes the proportionality of criminal law measures, their combination with preventive strategies and the need to ensure appropriate guarantees of human rights in the process of criminal prosecution. At the same time, the system of international standards - in particular the Safe System and Vision Zero concepts - reflects a shift in focus from punishment to eliminating risks by streamlining infrastructure, improving driver behavior control and creating a sustainable safe environment. As a result, legal norms become effective only if they interact with criminological interventions, digital technologies, systemic supervision and transnational coordination, which makes it possible to have a comprehensive impact on the causes and conditions of road crime.

Criminological analysis consistently demonstrates the dominant role of the human factor – primarily impulsivity, risk-taking behavior, alcohol or drug abuse, chronic fatigue, and failure to comply with basic safety rules. It is significant that most of these characteristics are persistent, long-term in nature, which requires targeted prevention programs for young and high-risk groups of drivers. At the same time, infrastructure deficiencies, poor quality of the road environment, insufficient lighting, and technical defects of vehicles act as catalysts and amplifiers of behavioral deviations. Socio-economic factors – inequality, limited access to education, low transport culture – form a broader context of criminogenic vulnerability. The use of systemic methods, such as the "Heddon matrix", demonstrates the need for a comprehensive approach in which behavioral, technical, environmental, and social factors are considered in relation to each other. This model is the most effective for predicting risks and developing effective programs for preventing road traffic offenses.

Modern mechanisms for preventing criminal offenses in the field of road traffic demonstrate that criminal law tools alone have limited impact without integration with demonstrably effective control methods, infrastructure changes and organizational measures. International practice confirms that the severity of sanctions is not a determining factor in deterrence: the perceived inevitability of punishment, the stability of law enforcement practice and the availability of correctional and rehabilitation programs are of key importance. The results of systematic reviews of Vision Zero programs, European models of automated control and local interventions prove that the best results in reducing mortality and injuries are achieved when criminal law regulations are embedded in a broad institutional ecosystem of safety management. This confirms the need to reorient the policy from "external strengthening of sanctions" to increasing the detectability of offenses, scientifically based standardization of practice and personalized prevention programs.

Comparative analysis proves that an effective policy of preventing offenses in the field of road traffic requires a combination of criminal law, forensic, criminological, engineering, social and technological instruments. None of them independently ensures a decrease in the level of accidents or serious consequences of road accidents. Criminal law performs a protective and regulatory function, but its potential is fully realized only if it is supported by effective control mechanisms, development of transport infrastructure, educational and rehabilitation programs. From this point of view, international standards and scientific research indicate the urgent need to transition from a purely repressive model to systemic prevention, which provides an impact on the causes, conditions and behavioral mechanisms that generate road crime.

For states undergoing modernization and European integration, the key is to harmonize criminal law with modern scientific approaches and European practices in road safety management. The primary tasks are to increase the efficiency of road crime investigations, strengthen the evidence base, develop digital surveillance systems, implement risk behavior assessment mechanisms, strengthen preventive strategies for young people and professional drivers, and improve infrastructure solutions. Consistent implementation of the principles of proportionality, fairness, and inevitability of punishment also remains important. The comprehensive implementation of such measures will contribute to a significant reduction in criminal offenses, increase the level of road safety, and strengthen the overall system for protecting the life and health of citizens.

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