

## БЕЗОПАСНОСТЬ ДОРОЖНОГО ДВИЖЕНИЯ

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### PROBLEMS OF SAFETY OF MOTOR VEHICLES

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***Abstract.** The article deals with the up-to-date problem of motor vehicles safety. The author concludes that traffic safety in the transport system depends on the type and, accordingly, the measures taken in vehicles to protect objects from unauthorized access and, as a consequence, from the possibility of accident or disaster occurrence, while the safety of vehicles on a traffic route is determined by external natural impacts.*

***Key words:** safety of movement, vehicle, transport system.*

### ПРОБЛЕМИ БЕЗПЕКИ АВТОМОБІЛІВ

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***Анотація.** Стаття присвячена проблемі безпеки транспортних засобів. Виконано комплексну оцінку безпеки транспортних засобів, конструктивної безпеки автотранспортних засобів та безпеки зовнішніх впливів за маршрутом руху. Будучи надзвичайно важливим компонентом інфраструктури України, автотранспорт забезпечує розвиток міжнародного культурного й технічного співробітництва та інтеграції України у світову економіку.*

***Ключові слова:** безпека руху, транспортний засіб, транспортні системи.*

### ПРОБЛЕМЫ БЕЗОПАСНОСТИ АВТОМОБИЛЕЙ

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***Аннотация.** Статья посвящена проблеме безопасности транспортных средств. Выполнена комплексная оценка безопасности транспортных средств, конструктивной безопасности автотранспортных средств и безопасности внешних воздействий по маршруту движения. Будучи чрезвычайно важным компонентом инфраструктуры Украины, автотранспорт обеспечивает развитие международного культурного и технического сотрудничества и интеграции Украины в мировую экономику.*

***Ключевые слова:** безопасность движения, транспортное средство, транспортные системы.*

#### Introduction

The concept of transport includes several aspects, which may be divided into infrastructure, driving, and vehicles. Infrastructure includes transport networks or transport routes that are in use (roads, railways, air routes, canals, pipelines, bridges, tunnels, waterways, etc.), as well as

transport junctions or terminals, which provide a reload of cargoes or passenger transfer from one mean of transport to another (for example, airports, railway stations, bus stops and ports). The role of transport is not bounded to transportation of cargoes and passengers only, it has a great impact on the whole process of extended reproduction that contributes to cultural and social

development of society. That's why transport is regarded to be one of the most important basic sectors of economy. Driving is understood as control over the system, for example, traffic light signals, railway switches, flight control, etc., as well as the rules (rules of funding the system: toll roads, fuel tax, etc.). Vehicles are usually represented by motor-vehicles, buses, trains and air-planes.

Vehicles are one of the most important sectors of the national economy; they function as a kind of a circulatory system in a complex organism of the country. Being an extremely important component of the infrastructure of Ukraine, vehicles provide not only internal cross-sectoral connections and satisfy the needs of the population in transportation, but they also enable delivery of passengers and export-import cargoes of various purpose in the interest of development of international cultural and technical collaboration, as well as integration of Ukraine into the Global Economy. Further development of vehicles and keeping their stable functioning under conditions of safety is a strategic aim of the state.

#### **Analysis of major studies and publications**

Problems of studying motor transport safety and problems of finding ways to improve it have been raised in numerous works by A.B. Abramov, D.A. Antonov, O.V. Bazhinov, Ju.B. Belenky, I.M. Bendas, L.A. Bigunov, V.A. Bogomolov, G.V. Borisenko, L.L. Borisov, V.M. Varfolomeev, A.A. Velikanov, V.P. Volkov, E.M. Gecovich, M.Ja. Govorushhenko, O.S. Grinchenko, B.B. Genbom, N.A. Gessler, A.B. Gredeskul, I.E. Djumin, V.A. Ilarionov, G.M. Kosolapov, O.P. Kravchenko, E.S. Kuznecov, R.V. Kugel, V.G. Kuhtov, A.T. Lebedev, M.A. Podrigalo, A.M. Turenko, V.N. Tkachov, A.S. Fedosov, E.A. Chudakov and in works by many other scholars [1–8].

#### **Formulation of the problem**

To consider various approaches to motor transport safety in road traffic safety system.

#### **Problems of safety of motor vehicles**

Transport system is a complex of various means of transport which interact while carrying out transportations. Movement of one of its components in the space (specifically of vehicles) is a

distinctive feature of the transport system [2, 3, 6]. Vehicles are usually represented by trains, air planes, cars, buses and bicycles.

Any transport system, being an open «man – vehicle» system, represents a unity of: vehicles, communications – transport infrastructure, and labor resources [4], which act in conjunction with each other and have certain interrelations. The integrity of this system lies in that it is not reduced to a simple sum of properties of its components. Elimination of one of the subsystems leads to disruption of safety of the whole system functioning.

Transport system as a complex organizational and technical system, the elements of which interact in a complicated way and affect one another [7], is characterized by technical, informational, legislative and legal, economic and labour connections. Existence of complicated ties between the components of the system complicates the problem of its safekeeping, and it requires the use of a system analysis that provides dividing of the problem into components, that would allow to develop some methodological and technical motions for its solution.

Like the other complex organizational and technical systems, the transport system has some distinctive features. Among these features are: an hierarchical structure, which involves a great number of interrelated elements (subsystems); existence of common purpose of the system functioning, to which some specific tasks of functioning of several subsystems are subordinated; availability of intense flows of information; functioning under the conditions of influence of spontaneous factors, including environmental factors; vulnerability to influence of spontaneous factors; presence of features of self-organization, that is the ability to reach a new stable condition due to change of their properties.

That shows that transport system has some features of metasystems, among which are: unpredictability: deep knowledge of each of the meta system elements, thorough and deep knowledge of its behavior in the past do not allow to accurately predict its condition in the future; purposeful nature: any mega system within certain limits is able to control its entropy under spontaneous influence and it is able to function in pursuit of certain goals; self-organization: the market, in which the system is functioning, pro-

vides control through the feedback that arises between its components.

The analysis of exploitation of transport systems that was conducted by A. L. Starichenkov [6–8] shows that it is impossible to consider all the factors, which have an adverse effect on safety of these systems, and to eliminate their unfavourable effects on human and nature because of spontaneous, objective nature of these factors. Even all the technical, organizational and other kinds of arrangements being realized, it can not be claimed that the risk of the system transition to a dangerous condition is precluded. In this case, it's necessary to distinguish a desired result – absolute safety, technical possibility and economic appropriateness of an acceptable safety level. That is why it's necessary to talk about a reasonably acceptable level of danger (risk), reaching of which often needs some complicated technical solutions and considerable economic expenses.

Under inadmissible change of condition of the system we should consider damaging of various severity level of health of road traffic parties, of environment, safety of transportation objects, as well as damage or destruction of technical means of the transport system, transport infrastructure and other property, by means of factors causing those or the other accidents. Among these factors are: adverse influence of the environment; failure of vehicle equipment and support facilities that ensure transportation; wrong actions of vehicle personnel; impact of cargoes, functional systems and devices; unsatisfactory dynamic characteristics of vehicles.

The presented analysis of the features of organization and functioning of the transport system allowed A. L. Starichenkov to formulate the principle of a complex assessment of safety of vehicles [6]. According to this principle the vehicle safekeeping process is to be considered as a combination of four components, among which are: constructive safety of vehicles; safety of movement of vehicles; safety of transportation objects in location areas, safety of vehicle driving and servicing. The formulated principle, being a universal one, may be used for consideration of any type of transport.

Considering the components of vehicle safekeeping processes, let's study a constructive safety of vehicles. It is characterized by: – safety of base constructions of vehicles, safety of a

power plant, systems and equipment of vehicles, safety of data processing systems and systems of vehicle control; and environmental safety of vehicles. Improvement of safety of the components, shown in Fig. 3 is possible when using the systems and means of technical diagnostics and prediction of their condition, as well as anti-breakdown control systems and information support systems for exploitation of vehicle equipment and struggle for survivability in emergencies.

Modern level of technics development proves the possibility of using (in various combinations) the following strategies for keeping constructive safety of vehicles: reliability strategy; fault-tolerance strategy; strategy of safe behavior in case of failure. At this point it's necessary to keep in mind that the reliability characteristics determine constructive safety only during the period of normal operation of a vehicle, while the survivability characteristics describe safety in emergencies. Constructive component of safety is usually settled at the stage of design and production of certain vehicle and its equipment, and it is determined by project arrangements, which improve vehicle safety [5].

Among the components of vehicle safekeeping processes safety of movement represents an integral notion as an object of consideration of a substantial component in overall safety of the transport system.

Safety of vehicle movement is characterized by: safety of a traffic route; safety of transportation objects; safety of external actions on a route (weather conditions, number of vehicles on a traffic route, etc.); safety of labor resources (personnel of vehicles) [1, 8]. Traffic route is chosen according to environmental safety, external conditions and time of delivery of transportation objects.

Safety of transportation objects depends on their type and, accordingly, on the measures taken in vehicles to protect objects from unauthorized access and, as a consequence, from a risk of accident or disaster occurrence. It is a thing of particular relevance for environmentally hazardous objects, because the transport that carries hazardous cargoes is the most vulnerable object to organization of terrorist acts.

Safety of external actions on a traffic route is determined by external natural impacts, as well

as by actions of other vehicles and their number on a traffic route.

Safety of labor resources is determined by condition of vehicle personnel and their knowledge of operating a mobile object on a traffic route. This component is characterized by existence of a corresponding transport company policy on guaranteeing a required qualification level of crew members by conducting trainings on prevention of accidents and by providing training facilities.

Crew of a vehicle – is a complicated complex of psychological resources, professional skills and qualification, and various social characteristics. This component is supposed to be the most critical for any type of transport. At the present moment “human factor” remains the main cause affecting the accident rate.

### Conclusion

Accordingly to the studies conducted it can be noted that when assessing safety of vehicles we must take into account each of the components discussed, since they all affect significantly the quality of the safekeeping process.

Vehicle safety is to be considered as a complex characteristics of a vehicle that determine its capacity to carry out transportation of passengers and cargoes without endangering lives and health of people, along with providing safety of cargoes, of a vehicle and the environment. According to the accepted definition, the main object of the vehicle safety theory is represented by an accident that results in threat to lives or health of people, safety of cargoes, of a vehicle and the environment.

### References

1. Белый О.В. Северный морской путь: проблемы и перспективы / О.В. Белый, Д.А. Скороходов, А.Л. Стариченков // Транспорт Российской Федерации. – 2011. – № 1(32). – С. 8–12.
2. Квитчук А.С. Проблемы совершенствования системы безопасности дорожного движения / А.С. Квитчук, Н.А. Синькевич // Транспортное право. – 2007. – № 4. – С. 12–29.
3. Кузнецов А.П. Актуальные проблемы обеспечения дорожного движения на современном этапе / А.П. Кузнецов, С.В. Изосимов, Н.Н. Маршаква // Тран-

спортное право. – 2007. – № 1. – С. 19–31.

4. Ложачевська О.М. Управління функціонуванням та розвитком транспортного комплексу регіону / О.М. Ложачевська. – К.: НАУ, 2002. – 248 с.
5. Скороходов Д.А. Принципы обеспечения конструктивной безопасности высокоскоростных морских и речных транспортных средств / Д.А. Скороходов, А.Л. Стариченков // Транспорт Российской Федерации. – 2009. – № 2(21). – С. 43–45.
6. Скороходов Д.А. Проблемы безопасности транспорта / Д.А. Скороходов, А.Л. Стариченков // Транспортная безопасность и технологии. – 2005. – №2(3). – С. 24–27.
7. Стариченков А.Л. Методика оценки безопасности транспортных комплексов / А.Л. Стариченков, И.В. Степанов // Транспорт Российской Федерации. – 2007. – №9. – С. 28–29.
8. Стариченков А. Л. Управление безопасностью: проверка на эффективность / А.Л. Стариченков // Судоходство: международный журнал, март 2007. – №3 (128). – С. 14–15.

### References

1. Belyj O. V., Skorohodov D. A., Starichenkov A. L. Severnyj morskoy put': problemy i perspektivy [Northern Sea Route: Problems and Perspectives]. *Transport Rossijskoj federacii - Transport of Russian Federation*, 2011, no. 1(32), pp. 8-12.
2. Kvitchuk A.S. Problemy sovershenstvovaniya sistemy bezopasnosti dorozhnogo dvizheniya [The Problems of Improving the System of Road Traffic Safety]. *Transportnoe pravo - Transport Law*, 2007, no. 4, pp. 12-29.
3. Kuznecov A.P. Izosimov S.V., Marshakova N.N. Aktual'nye problemy obespecheniya dorozhnogo dvizheniya na sovremenom jetape [Urgent Problems of Road Traffic Maintenance on Current stage]. *Transportnoe pravo - Transport Law*, 2007, no. 1, pp. 19-31.
4. Lozhachevs'ka O.M. *Upravlinnja funkcionuvannjam ta rozvitkom transportnogo kompleksu regionu* [Control Over Functioning and Development of Transport Complex of the Region], Kyiv, NAU, Publ., 2002, 248 p.
5. Skorohodov D.A., Starichenkov A.L. Principy obespecheniya konstruktivnoj bezopasnosti

- vysokoskorostnyh morskikh i rechnyh transportnyh sredstv [Principles of Maintaining Constructive Safety of High-Speed Marine and River Vehicles]. *Transport Rossijskoj federacii - Transport of Russian Federation*, 2009, no. 2 (21), pp. 43-45.
6. Skorohodov D.A., Starichenkov A.L. Problemy bezopasnosti transporta [Problems of Transport Safety]. *Transportnaja bezopasnost' i tehnologii - Transport Safety and Technologies*, 2005, no. 2(3), pp. 24-27.
7. Starichenkov A.L., Stepanov I.V. Metodika ocenki bezopasnosti transportnyh kompleksov [Methods for Assessing Safety of Transport Complexes]. *Transport Rossijskoj federacii - Transport of Russian Federation*, June, 2007, no. 9, pp. 28-29.
8. Starichenkov A.L. Upravlenie bezopasnost'ju: proverka na jeffektivnost' [Safety Management: Efficiency Check]. *Sudohodstvo - Shipping: International journal*, March, 2007, no. 3(128), pp. 14-15.

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