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## Modular Management of Indicators of Efficiency and Safety of Transportation Processes

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### Abstract

The article examines mechanism of the transportation processes (TP) modular management at all stages of its development and implementation. Analysis has been completed of the factors that determine TP efficiency and a vehicle traffic safety during cargo transportation. Methodological backgrounds have been considered for perfection of efficiency and safety of transportation processes of cargo transportation by motor transport in conditions of incomplete certainty. Quality and safety is ensured by creation of reconfigurable transportation processes modules and invariant condition systems and efficiency and safety indices.

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### 1. Introduction

Provision of the specified efficiency indices of a wide range of cargo transportation by motor transport requires development of the transportation system structure (TS) invariant of the requirements for transport service indices meeting, and meeting the conditions and characteristics of the road environment.

The approved methods of transport process (TP) development and management are, as a rule, based on the use of reference data or experience of a motor transport enterprise. Development and selection of TS and TP using the

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superposition principle in the uncertainty conditions, are caused by market relations does not completely ensure effective results.

## 2. Main part

The article presents a new approach to the transport process management based on the modular presentation of its elements. In the paper the problem resolution is ensured by provision of carriage efficiency and achieved by the modular structure of TS and TP management at the stages of TP organization and implementation. The task is solved by revealing the links between elements of the system "Driver-Vehicle-Road-Environment" (DVRE) and formation of the manageable system core invariant of the required technical and economic indicators, input information on the conditions of a transportation service provision and the road environment characteristics [Stepanov et al. (2011)]. This approach ensures creation of a transportation system, which allows to adequately respond to changes in the conditions of internal and external environment and the traffic situation changes.

In order to reveal links between modules of the system DVRE set-theory analysis and structural synthesis methods were used [Baskov and Kozhuhovskaya (2013)]. Use of structural analysis is conditioned by the fact that structure reflects both the substantial aspect of TS and TP and change of the communication form during their adaptation to the new conditions. The structure-forming factors that determine the management conditions and synthesis of the transport system structure invariant core and the limits of its stability, taking into account the cargo carriage specific conditions and safety requirements were detected on the basis of the structural analysis of the transportation process elements. Performance and safety resulting from factors classification manifesting in the inner and outer environment were accepted as the characteristics of the transportation processes determining its efficiency.

The following inner environment various factors affect the performance and safety of the transportation process: TS structure; vehicles performance criteria (VPC); organizational methods of motor transport enterprise, etc. The level of traffic organization, characteristics and state of the roads and informational support level of the transportation processes, etc. were considered as the external environment influencing factors [Baskov and Kozhuhovskaya (2013)].

Creation of TS core invariant of the changing conditions needs the analysis of the initial information on the properties and transport characteristics of carried cargo {G}, vehicles, logic of TP structures formation and selection in order to determine effect of the characteristics of the DVRE system transport capacity on the structure of the core {TS} invariant of the execution conditions {TP} [Baskov and Kozhuhovskaya (2013)]. For this purpose, we have examined formation conditions and change of the TS state, while ensuring the efficiency and safety of each TP option.

Indicator of organizational and technological sustainability and adaptability of DVRE system modules reflecting its changeability for a variety of carried cargo {G} characteristics without changing of TS target function and without transportation process efficiency and safety deterioration was taken as the invariance level indicator.

Ensuring TP efficiency by its manageable core and quality and safety indicators of DVRE system modules are considered as the system's ability to maintain function and TS – w (t) target organization in case of situation change, the input information ( $X_{ij}$ ) on the conditions of the development and course of the transportation process and criteria for its evaluation [Baskov and Kozhuhovskaya (2013)].

Incompliance of properties {G}, {TP} and structures of the S {TS} in multivariate of services provision identified the need to study the structure – to – function correlations, establishment of quantitative relationships between their elements under conditions of incomplete certainty. As conditions of safety process ensuring during cargo carriage, the permissible time required for their implementation also have incomplete certainty required to develop rules of fuzzy information transformation into clear one through step – by – step disclosure of uncertainty in using the developed criteria system. In order to achieve the target during determination of quality indicators of element sets correspondence {G}, {TP} and {TS} the set-theoretic analysis was used, and on the basis thereof the influence extent was determined of the dominant factors on TP structure and DVRE system, on the criteria to select an optimum combination of their properties (Fig. 1).

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