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Transportation Research Procedia 20 (2017) 373 – 377

Transportation Research Procedia

www.elsevier.com/locate/procedia

12th International Conference "Organization and Traffic Safety Management in large cities", SPbOTSIC-2016, 28-30 September 2016, St. Petersburg, Russia

Algorithm for Risk Assessment in the Introduction of Intelligent Transport Systems Facilities

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Abstract

Introduction of intelligent transport systems (ITS) facilities is a complex and time consuming process. It requires developing various ITS architectures, a clear definition of tasks (needs of the user) and compilation of databases. In order to avoid negative results of introduction of ITS projects, a new approach in designing ITS, taking into account all possible risks of each stage of designing and introducing ITS facilities, becomes a priority. The paper proposes an algorithm for risk assessment during introduction of ITS projects. A risk management system is required for identification, grouping and analysis of major risks of ITS, as well as for developing the ways to mitigate possible risks.

Peer-review under responsibility of the organizing committee of the 12th International Conference “Organization and Traffic Safety Management in large cities”

Keywords: intelligent transport systems; traffic flows; safety; efficiency of operation of a transportation network; ITS architecture; risk analysis; risk management

1. Introduction

Efficiency and safety of operation of transportation networks of modern cities is performed with the help of extensive use of intelligent transport systems (ITS). Transport policy of all developed countries of the world has been based on developing and promoting intelligent transport systems, as well as creating a common information space, for over 35 years.

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Peer-review under responsibility of the organizing committee of the 12th International Conference “Organization and Traffic Safety Management in large cities”
doi:10.1016/j.trpro.2017.01.056

The principle of primacy of developing ITS architecture implies a systematic approach, which allows avoiding possible difficulties in development of intelligent transport systems. The design of the system ensures consistency of operation of traffic management subsystems of any level. The ITS architecture comprises all tools to solve the issues of traffic flow management.

The objective of this paper is to develop a methodology for determining the risks associated with introduction of ITS facilities. The subject of the study is the risk affecting efficiency of introducing intelligent transport systems facilities.

2. Main text

The high level of motorization of modern cities has led to complications in functioning of the automotive transportation system, i.e. reduction of speed of vehicles and constant traffic jams. Failure to meet demands and quality of road transportation impacts on various economy sectors of regions and the country as a whole. Introduction of intelligent transport systems (ITS) becomes one of the most challenging ways to solve transportation problems [Darido et al. (2003), Zhankaziev (2016), Nazer and Jaffe (2006)].

As a rule, introduction of certain ITS facilities can greatly enhance efficiency of road transportation. In order to avoid risks and negative results in introducing ITS projects, a new approach on redistribution of traffic flows and forecasting of subsequent changes in operation of road networks becomes a priority [Kerner (2009), Naumova and Zyryanov (2015)].

Risk management, including development of risk prevention plans and risk mitigation programs, is one of the most important stages in introducing intelligent transport systems facilities. The risk management system is required for identification, grouping and analysis of major risks of ITS, as well as for developing the ways to mitigate possible risks (Table 1).

Table 1. Assessing performance of intelligent transport systems introduction.

The result of ITS development	1994	2004	2006	2009
Project targets are achieved	16%	29%	35%	32%
Project targets are achieved partially	53%	53%	46%	44%
Project targets are not achieved	31%	18%	19%	24%

Therefore, it is reasonable to include the following steps of designed risk assessment algorithm into the ITS architecture:

The first step: planning introduction of an ITS facility. This step includes actions aimed at risk elimination and minimization of its consequences: threat assessment, risk analysis and risk treatment. Often, errors made at this stage lead to irreversible negative consequences. For example, estimates of growth in demand for the route Greenway Dallas (USA) was assumed at 14% in the first six years according to specialists' estimates during development of the route project [Damnjanovic (2009)]. But, the initial assessment of 34,000 vehicles per day proved to be too optimistic, since the actual daily average intensity totaled 11,500 vehicles, which led to considerable financial losses of the project.

The second step: selection of risks. It is impossible to manage risks as long as they are not clearly defined. This step involves identification of risks in order to determine real threats. These risks may include failure of data transfer, increase in the cost of services, violation of traffic safety level, social instability of the society, lagging development of the region, adverse impact on the environment [Zhankaziev and Vlasov (2010)].

The third step: risk analysis. Once all possible risks of the project are identified, detailed analysis aimed at identification of most probable and dangerous risks is required for further work with them.

The fourth step: dealing with risks. The step includes identification of measures necessary to deal with problems identified during the risk assessment. One of the methods of risk preventing may be online control, which would