Conceptual framework for the formation of the integrated intelligent transport system in Ukraine

Abstract. Introduction. The research is dedicated to the conceptual framework of the integrated intelligent transport system (ITS) formation in Ukraine. The author presents different approaches and technologies in the field of the functional structure of the integrated intelligent transport system optimisation and describes the influence of the integrated ITS creation on political, economic and social situation in Ukraine. Purpose. To develop a conceptual framework of the integrated intelligent transport system as a balanced synergetic factor of the transport sector development in Ukraine. Methods. In order to achieve the goal set in the article, the appropriate methods have been used based on the systemic approach, artificial intelligence, management theory and decision-making theory. The system analysis was used to define the scientific task. Results. The study related to the development of the conceptual framework for the formation of the integrated intelligent transport system has made it possible to introduce approaches and technologies in the field of ITS functional structure optimisation and determine its principal components. The functional structure of the proposed integrated intelligent transport system includes implementation of a modern methodology of mathematical transport modelling, which provides an objective, comprehensive and advanced approach to planning and solving problems of the transport industry of Ukraine. Conclusions. The global experience and the results of the implementation of ITS are invaluable. The creation of the integrated ITS in Ukraine should provide not only solutions to specific problems, but also improve the efficiency of the transport system in general. The proposed conceptual framework for the formation of the integrated intelligent transport system in Ukraine may be useful for government authorities, transport enterprises and consumers of transport services.

Keywords: Country’s Competitiveness; Intelligent Transport System; Transport Infrastructure; Transport Flows; Management Structure

JEL Classification: F20; L86; L90; O10; R41

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1. Introduction

The objective growth of traffic intensity, its load on the infrastructure, its impact on the environment, as well as the implementation of modern information systems in transport and infrastructure facilities, require proper management of the transport processes. The current use of intelligent transport systems is an effective innovative approach that can ensure an increase in the competitiveness of Ukraine both in the domestic and international markets. The creation of the integrated intelligent transport system requires the application of a comprehensive approach which should include the mechanism of state management, the relevant road infrastructure and an intelligent information system to manage the transport system. ITS should be created as a unified centralised system of the Ukrainian transport system management, rather than the complex of local management systems. Its creation, development and integration into the existing local transport systems, as well as the standard design solutions based on the use of advanced foreign technologies, should be viewed as an important stage of the implementation of the integrated ITS. This approach will allow avoiding mistakes in the design of the intelligent system, optimizing terms and expenditures for its creation, change the existing principle of local informatization for each mode of transport.
Intelligent transport is an essential element of the «smart city». The development of the «smart city» can be applicable to many sectors of city management: its transport, «electronic government», energy, health care, construction and public life. Innovations that save and optimise resources can be introduced in each of these areas. Table 1 presents approaches and technologies in the field of optimisation of a number of transport tasks.

In order to solve traffic problems in Ukraine the aforementioned measures should be introduced and improved by using the global experience on travelling demand management, reducing the load on the transport infrastructure where it is needed.

<table>
<thead>
<tr>
<th>Tab. 1: Methods and technologies for demand management in transport</th>
<th>1. Reduced demand for personal transport travels / Increased operating costs when using motorised transport for travels in the city</th>
<th>Examples of use</th>
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<tr>
<td>No</td>
<td>Demand management measures</td>
<td>1.1 Organisation of paid parking spaces in the downtown</td>
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<tr>
<td>1.2</td>
<td>Entry fee into the downtown</td>
<td>Stockholm (2008); London (2003)</td>
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<tr>
<td>1.4</td>
<td>Additional taxes for vehicle owners / registration fee</td>
<td>Singapore</td>
</tr>
<tr>
<td>1.5</td>
<td>Organisation of the streets system with a quiet traffic / consistent spaces with pedestrian priority</td>
<td>Cities of Germany</td>
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<td>2. Increased demand for non-motorised travels and travels in public transport</td>
<td>2.1 Development of the public transport system based on the principle of the public transport priority over the private transport in the traffic organisation</td>
<td>European cities, Bogota (2000)</td>
</tr>
<tr>
<td>2.2</td>
<td>Development of the main public rail transport</td>
<td>Cities of Germany (S-Bahn; tram lines); Helsinki</td>
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<td>2.3</td>
<td>Intelligent transport systems; elements of the «smart city»</td>
<td>Barcelona; Australia; Canada</td>
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<tr>
<td>2.4</td>
<td>The system of public bike rent</td>
<td>Copenhagen (1995); Paris (2007); Moscow (2013); St. Petersburg (2014)</td>
</tr>
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<td>2.5</td>
<td>Development of the system of transport interchange hubs</td>
<td>Cities of Germany</td>
</tr>
<tr>
<td>2.6</td>
<td>Creation of a comfortable pedestrian communication system in the downtown</td>
<td>Copenhagen; Paris (La Défense downtown)</td>
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<td>2.7</td>
<td>Introduction of a unified hourly payment system for travel by all modes of transport</td>
<td>Berlin; Copenhagen, Prague</td>
</tr>
<tr>
<td>2.8</td>
<td>Increasing of public transport accessibility and quality of passenger services</td>
<td>European cities</td>
</tr>
</tbody>
</table>

Source: Based at data from http://ertico.com
Therefore, the above studies on the implementation of certain activities and information systems in the transport sector activity of different countries allow us to form the Functional management structure of Integrated Intelligent Transport Systems shown in Figure 1.

The proposed functional structure of the integrated intelligent transport system provides an introduction of the elements of transport imitation modelling. In this case, a transport model is a mathematical computer model of transport, which is a combination of databases on the transport infrastructure and the geo-platform.

The expected results of the creation of the integrated ITS in Ukraine may be:

- the development of the procedures to improve the efficiency and operation of the transport system, as well as a regulatory framework for the regulation of transport;
- the creation of inquiry and communication of the transport sector management;
- the creation of a mechanism of information delivery to government authorities and other interested persons about the operation of the transport sector;
- the improvement of the transport network and reduction of the negative impact of vehicles on the environment.

Further on, we will examine the impact of goals of the integrated ITS creation on the needs of the society and the

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**Fig. 1: Functional management structure of the Integrated Intelligent Transport Systems**

Source: Compiled by the author

References (in language original)

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References (in language original)