Proposals for the Development of Information Support for the Management of Transport Infrastructure of MOSCOW

[*1]Mamedova Natalya and [2]Fedorova Marina

[1]PhD in Economics, Associate Professor, Department of State and Municipal Management
Plekhanov Russian University of Economics, MOSCOW
[*]Corresponding author E-mail: *nmamedova@bk.ru*

[2]Bachelor of "State and municipal management"
Moscow State University of Economics, Statistics and Informatics, MOSCOW

Abstract: This article presents the results of the study areas of information management system in the management of transport infrastructure of Moscow. As a result of the analysis of the fundamental problems in this area was presented a set of measures to improve the transport situation in the city, in particular, creating innovative data center using cloud technology and storage, information systems support for the scheduling of transportation and modernization work of Intelligent Transport Systems. In accordance with the proposed solutions for the development of an information management system in the management of transport infrastructure of the city of Moscow was proposed feasibility study of managerial decisions. Scientific novelty of the results of the study is to establish a systematic approach to the process of management of the transport infrastructure of the city of Moscow with the help of modern information technology. The practical significance is to identify the objective conditions for the implementation of complex engineering systems to improve the management of transport infrastructure of Moscow.

Keywords: Transport infrastructure, Intelligent transportation system, Data center, Cloud technology

I.   INTRODUCTION

This article deals with the organization and development of information support in the field of transport infrastructure of Moscow. Transport infrastructure for research is defined as a set of material-technical and organizational conditions to ensure prompt and free execution of the transportation process is one of the indicators of living standards. It is obvious that an effective solution to the problems of the transport infrastructure of the city is impossible without revising the urban priority of the principle of the development of urban areas of different functional purpose. At present, the complexity of managing the transport infrastructure of the city of Moscow is aggravated by the fact that no single field of information security, there is no unified information system, which leads to fragmented management of various types of transport. As a consequence, this leads to a lack of an effective system of traffic management. To implement a set of proposals for the development and functioning of the transport system of the city of Moscow was developed a proposal in the form of a supplement to the state program of the City of Moscow "Development of transport system for 2012-2016." To create innovative data processing center (hereinafter - DPC) using cloud technology and the upgrade work Intelligent Transport System (hereinafter - ITS). The proposals are designed to improve the transport infrastructure in view of the current situation in the city. The economic rationale developed proposals formed with reference to the complex management problems identified transport infrastructure. The purpose of the study is to develop cost-based approaches to the development of

transport infrastructure of the city of Moscow by implementing best practices in the field of information provision of urban infrastructure.

II. MATERIAL AND METHODS

Feature facility management of urban infrastructure at the present stage of social development is that management decisions accompanied by processing of a large amount of information and input. To meet the rapidly changing realities of the information in the development of transport infrastructure of the city of Moscow is necessary to use advanced tools and innovative data center using cloud technologies. Data Center is a unique and complex set of engineering systems, which should be fully responsible for the provision of IT-services with predefined quality indicators. As an example, we describe the organization and management of the data center operating at the regional level. DPC is created for the benefit of a particular government body. Application software in the regional data centers is based on the transactional and analytical subsystems subordinate institutions (organizations), as well as their electronic archives. DPC integrates into a single data base of institutions (organizations) which have been stored, including at the municipal level. Thus, the authority of regional government gives data center functions that perform subordinate bodies of different levels within a functional administration. The transfer of the functions in the data center helps concentration subordinate bodies on their direct activities. Specially created by the organization or entity which transferred the functions of the data center management, is engaged in the conduct of functions for processing data information growth, provides requirements for operational data processing, its storage and accessibility, as well as engaged in the implementation and operation of modern on-line services, increases the efficiency of the administration of transport infrastructure. As a result of the creation and operation of the data center for the development of transport infrastructure provides an opportunity within the existing technologies to ensure continuity of management processes.

DPC facilitates the management scale and diversity of structures and is able to control and monitor the operation of all types of transport of the city. Creating a data center will meet the need for rapid analysis of information, the establishment of accurate forecasts, assistance in making urgent decisions when working with findings, which comes from various and diverse sources of information under the control of the data center, as well as to develop and upgrade on this basis intelligent transport system (ITS).

ITS is designed for effective traffic management, increasing the capacity of the road network, to prevent road congestion, reducing delays in traffic, improve road safety, informing road users of the prevailing road and traffic conditions and options of optimal routes, ensuring the smooth traffic on urban transport [2, p. 67]. Data that accumulates and processes the ITS can be used to develop mathematical models for spatial analysis of road traffic in solving problems of modification of the road network of the city, as well as neural network control spatially coordinated transport infrastructures [4, p. 409]. The structure of ITS should include:

- Monitoring system parameters of transport streams for further processing and analysis of indicators in the data center (by installing intelligent television cameras review and innovative detectors, monitoring traffic conditions);

- System for informing road users of the difficulties of all types of transport (by means of information of urban signs, and mobile application development "Transport in Moscow", indicating what type of transport is now the fastest to get from one point to another city);

- System of technical facilities management and organization of traffic (such as strip reverse traffic and intelligent switching of traffic lights);

- Management system of parking spaces (parking space analysis function is recommended to include in a single mobile application "Transport in Moscow" for the user to select the least loaded parking to accommodate your vehicle);

- A system of photo and video fixation of violations of traffic rules;

- System navigation and information support based on GLONASS;

- Emergency alert system of special services of transport accidents or traffic accidents (similar to the European system of notification of an accident «e-Call») on the basis of satellite navigation system GLONASS / GPS Russian production.

Given the direction of information flow in the intellectual transport management system, it should be noted that data for monitoring and analysis of the traffic situation received via the data center by means of the ITS data from special cameras, innovative sensors mounted on public transportation, parking, and information received from the satellite. All information is recorded in the data center, processed and transmitted information system of road traffic on the difficulties of all kinds of transport.

We represent the organization and the basic steps of creating a data center for the development of transport infrastructure.

- *Development of a concept for the organization of the data center.* In order to achieve maximum economic efficiency of the project should be carried out full details of the objectives and competencies of the organization. Data centers based on cloud technologies created for the effective management of the development of transport infrastructure of the city of Moscow, the coordination of general information on all modes of transport, the analysis of the data.

- *Creating a data center project.* Having formulated the goal of the project is necessary to determine the components of the components, such as the expected computing power, the components, calculate the risks and methods to reduce them, to carry out documentation and agree on a master plan with the Customer. In the role of the customer to create innovative data center for the development of transport infrastructure will be the Department of Transportation and Development of road transport infrastructure of the city of Moscow.

- *The implementation of the project.* This stage can be considered one of the most lengthy and time-consuming. During the project will build a dedicated building for the data center, to purchase necessary equipment, install software, configure and synchronize the operation of all subsystems of the data center.

- *System Maintenance.* At this stage, the frequency of consistent implementation of preventive measures to be agreed on the basis of size and destination data center.

The project is innovative data center and ITS (as well as for application development "Transport Moscow" requires the creation of cloud storage information system to support the scheduling of transport (hereinafter - ISPD), which will use advanced computer technology to solve problems in the processing flow of the global amount of data to solve the issues of information security and reduce the costs of operating the system.

The system of benefits provided by the technology of cloud storage should be used fully. Integration of clouds in the work of the data center will increase the volume of processed data that are required in the system and reduce the requirements for its total cost (the cost of implementing the system). Consequently, the establishment and integration of cloud storage becomes necessary direction in the development of innovative data center and ITS (as well as for application development "Transport of Moscow"). As a result of the development ISPD promotes effective enforcement needs

of users of the transport system. The benefits of cloud storage solutions provide opportunities for a whole range of difficulties in creating innovative data center using ITS ISPD created to address traffic congestion. These advantages are:

- *Scaling.* Cloud storage in terms of implementation of the proposed operation of the data center provides the creation and maintenance of reserve resources. So when the dynamic data extraction is greatly increased system utilization due to the fact that at high loads are dynamically increased (respectively, at low loads redundant resources are released).

- *Convenience.* To meet the objectives assigned to the data center, you need to use cloud storage, allowing geographically-separated users to work with some sources of information without failures and delays. When working ISPD users, opening files in the cloud will be able to access and change management information without time and space limitations.

- *Cooperation.* To use innovative data center is important to ensure collaboration between participants in real-time data that will greatly increase the efficiency of data communication. These tasks are easily accomplished using cloud storage. These tasks are easily accomplished using cloud storage.

- *Low Cost.* Cloud server is much more cost effective than traditional server technology. Its use will reduce the amount of initial investment in creating innovative data center, and will reduce the need for the development and subsequent operation of investment.

Thus, the zoom function of cloud storage system will solve the problem of congestion in data warehousing ISPD. According to the data center does not require significant resources to purchase expensive servers, users will be provided by the joint work in real time, which will eliminate barriers between geographically remote users.
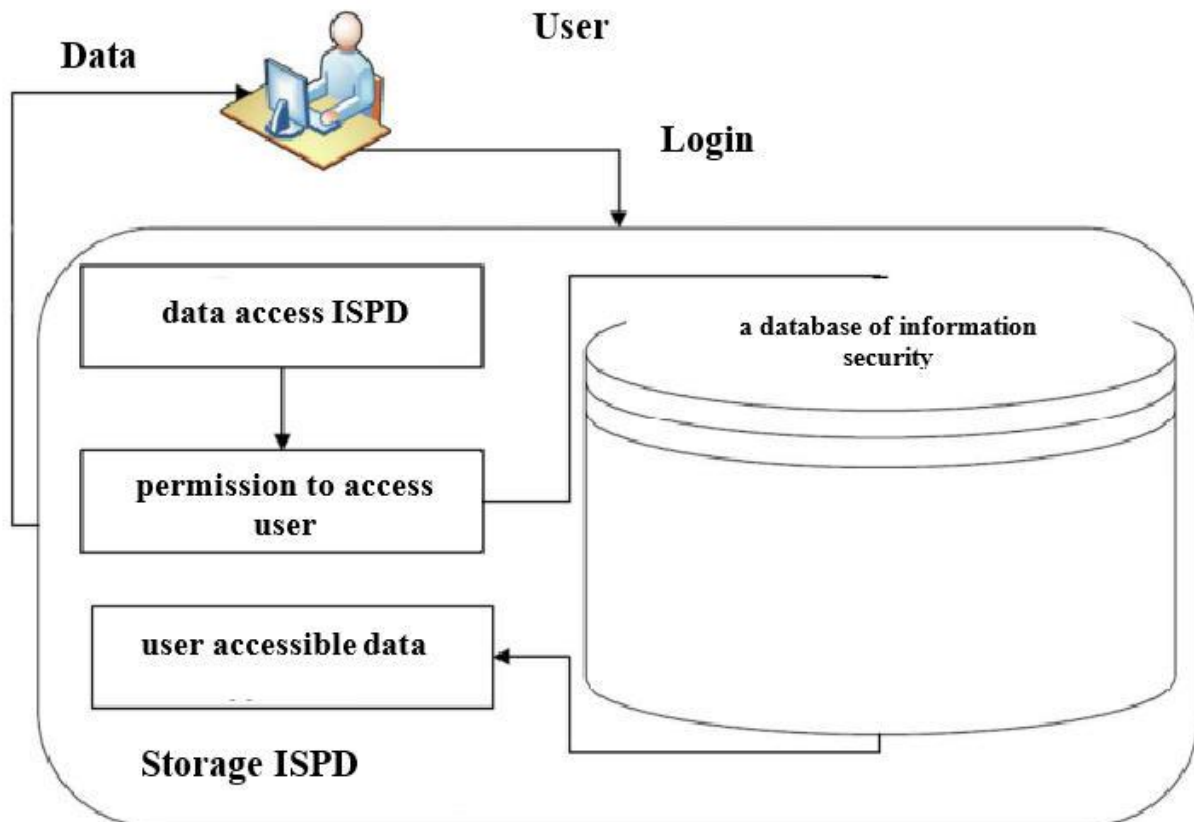

Figure 1 - File Access cloud storage ISPD

Cloud storage requires only the initial costs, which will be used to create innovative data center installation and configuration "cloud" solutions. After the data storage conditions can be used in practice by ordinary users. Members ISPD access to the application interface, directly connected with the cloud service. To do this, the user can use a computer, tablet or mobile phone. Figure 1 shows the file access cloud storage ISPD.

The proposed structure ISPD includes data storage management application interface, system access, and file system organization to work together on a single source of data. Creating a system of cloud storage ISPD for operational functioning of innovative data center involves the development of new opportunities and directions for research, and improving the efficiency of transport services.

III. RESULTS

The result of the introduction of a set of proposals for the development of control systems of transport infrastructure of the city of Moscow is the projected economic impact and its attendant social significance. The complex of the proposed measures aimed at addressing the problems identified in the analysis of the control system of transport infrastructure. The proposed measures are in addition and updating of the state program of the city of Moscow "Development of transport system for 2012-2016." With the prospect of the introduction until 2020.

1. One of the expected outcomes of the program of the city of Moscow "Development of transport system for 2012-2016." Is to increase the volume of public transport by 40%. According to the results of the study suggest that the introduction of innovative data center will be able to increase this figure to 40 to 47%. The purpose of the proposed research is to increase the proportion of citizens who have renounced the use of private vehicles in favor of the public, to reduce the load on the road network of the city, reducing the time path of moving from one point to another of the city, as well as solve the problem of traffic congestion in general.

2. Also, as a result of the introduction of the complex proposed measures is projected to decrease average range of motion on ground city passenger transport in an hour "peak" from 8 to 4 minutes. The initial results of the program of the city of Moscow "Development of transport system for 2012-2016." Anticipated decrease in the average range of motion up to 5 minutes. Reducing the planned target to 4 minutes to reach the proposed through the introduction of innovative data center management and technical means of regulation of traffic. For this purpose, it is recommended to use: band reverse traffic; increasing the number of lanes for public transportation by analyzing data obtained using the system monitoring parameters of transport streams; intelligent switching of traffic lights; Setting priorities for public transport controlled junctions, bus priority at the exit of the bus parks and "pockets" to public transport. These tools are characteristic of smart-roads [5, p. 29], which are used in cities such as Singapore and Hong Kong and form part of the E-logistics [6, p. 2-8]. Thus, the comfort will be increased and the attractiveness of public transport and these measures will encourage the rejection of private vehicles, which is one of the main goals of the state program of the City of Moscow "Development of transport system for 2012-2016."

3. The result of the implementation of the proposed measures is also a reduction in the average time spent on the trip from residential areas to places of employment by 20-25%. The expected figure will be achieved through the development of innovative data center applications, "Transport of Moscow", responsible for the construction of the optimal transport route using analytic data traffic congestion and public transport. Thus, a discharge of tension and transport optimization of load distribution between the different modes of transport. For comparison, the indicators specified in the Program is 15%.

4. The projected rate of speed of movement of public transport in the hours of "peak" of 20 km / h (basic rate - 11 km / h), including on dedicated lanes of 35 km / h (basic rate - 30 km / h). The

social significance of this indicator is to reduce the time that people spend on the road when moving from one point to another city. This figure is expected to achieve a method similar to that which we have given for step 2. Target specified in the program is 25 - 30 km / h.

5. One of the socially relevant effects of the introduction of the proposed measures is to curb emissions of pollutants from motor vehicles. In Moscow, as in most large cities, among the main sources of air pollution include motor vehicles. The gas mixture produced by the vehicle engine, a mixture containing a complex mixture of more than two hundred components, including a huge number of carcinogens. Harmful substances coming into the air, causing huge damage to human health. That decrease in the number of private vehicles will be used to improve the ecological situation in Moscow and reduction of sources of air pollution. In evaluating the effect of reducing the environmental burden is considered the damage to the environment due to the emission of pollutants from vehicles to air during transport in Moscow.[1] At the same time, the effect of reducing the environmental burden through the implementation of the program amounts to 0.15 trillion. rubles.[2]

6. It is predicted to reduce the time for the transplantation of passengers in major transport interchange nodes from 15 to 4 - 7 minutes. Currently transport interchange nodes designed for transfer of passengers to land passenger transport on high-speed off-street. The main purpose is to ensure the transition nodes passengers' intercity transit of individual transport and improving conditions of service of public transport. The main effect of the introduction of the program of development of transport infrastructure will decrease upload traffic urban roads and improving conditions of service of public transport due to the application "Transport in Moscow", has developed an innovative data center.

7. Another socially significant effect of the introduction of the proposed measures is to reduce 4-5 times the arrival of rescue teams during emergencies. This will contribute to the implementation of the emergency notification of special services of transport accidents or traffic accidents (similar to the European system of notification of an accident «e-Call») on the basis of satellite navigation system GLONASS / GPS Russian production. This will reduce the number of deaths in accidents in transport, social risks, as well as improve road safety.

As a second phase study designed measures calculated the cost of the proposals. The total funding of the state program of the city of Moscow "Development of transport system for 2012-2016." Is 2,273,051 488.7 ths. Rubles. (Including the budget of Moscow - 1,616,645 508.7 ths. rubles.). Of these, the organization of traffic in the city and the creation of the Intelligent Transportation Systems (ITS) is allocated total funding of $ 25,869,729.0 thousand. Rubles. These assets are recorded in the volume of investment in transport infrastructure in the total amount of investments in the region, which is an indicator of the development of transport infrastructure in the region [3, p. 790].

It is possible to use part of the budget planned for the development of ITS, in order to implement the proposed activities to create innovative data center. In general, for the implementation of developing innovative data center using cloud storage technology and ISPD and modernization work of Intelligent Transport System will require 5 billion. Rubles. This figure is comparable to the practice of creating data center projects. For example, when creating the MI FNS on the data center has been spent 5 billion. Rubles, and for the construction of the data center in Dubna, FNS has been spent 7 billion. Rubles.

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[1] Conclusion The Department of Natural Resources and Environmental Protection of Moscow № 05-06-102 / 11 of 4.05.2011 Access from the reference legal system "Consultant Plus".

[2] State program of the City of Moscow "Development of transport system for 2012-2016". Access from the reference legal system "Consultant Plus".

The following is a calculation of the time and resources required for the implementation of the state program developed proposals with a view to 2020. The total funding of the program to create ITS five years amounted to 25,869,729.0 thousand. Rubles, therefore, the average annual amount of funding equal to 5,173,945.8 thousand rubles. To implement the program of creating innovative data center for five years will require annual allocation of funding from the general budget in the amount of ITS 1000000.0 thousand. Rubles, which is about one-fifth of the budget.

IV.   CONCLUSION

Thus, it is worth noting that the recommended proposals formed with the latest trends in modern and innovative in solving problems of the transport infrastructure of the city of Moscow, developed taking into account the current economic situation. Plan for the introduction of the object of intellectual transport system until 2020, designed to transmit data in the data center and their subsequent analysis and processing, is presented in Appendix 2. We have formulated a proposal for a socially significant improvement in transport infrastructure, and given its economic justification. All the proposed activities have a high social value; the expected results of the program will contribute to the improvement of the transport infrastructure of Moscow.

It is also necessary to emphasize the importance of strict adherence to the principles of the recommendation to supplement and update the state program of the City of Moscow "Development of transport system for 2012-2016." To create innovative data center using cloud technology and the modernization of the smart city transport system in order to maximize the effect of the ongoing activities under the program. Justification developed proposals implemented by evaluating indicators of traffic problems with the latest modern trends and best practices in addressing issues of transport infrastructure management, presented with the current funding of the program and the current economic situation in the city of Moscow.

V.   REFERENCES

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