BENEFITS OF INTELLIGENT TRANSPORT SYSTEMS

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Abstract: *The aim of this work is to get acquainted with Intelligent Transport Systems, their applications, operation and benefits that they bring to individual road users. ITS consists of a wide range of facilities and tools aimed at managing the transport network and providing services to road users in order to increase transport efficiency. The three basic principles of IDS consist of information, communication and integration. IDS and are used in all modes of transport, but are most common in road transport. ITS also contributes to increased productivity, economic growth and employment growth. Improving the performance of the transport system ensures that people and products reach their destination as quickly and efficiently as possible, which increases the productivity of workers and businesses and increases the country's competitiveness.*

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1. INTRODUCTION

In recent years, the world has seen a sharp increase in the number of cars on the road. This is causing a critical road situation, especially in the US, Western Europe and East Asia, especially in Japan, South Korea or East China. However, developing countries such as India, where the transport network is not yet sufficiently built, are also seeing an increasing increase in cars.

Traffic jams are a huge problem, because only the average American spends about 5 days a year just waiting in traffic jams. These also result in an increased number of traffic accidents, increased fuel consumption and, last but not least, an increase in emissions into the air. Due to the bad situation on the roads, the time of transporting people to work is slowed down and companies' productivity suffers, they also delay the delivery of material that, instead of being part of the transformation process, is somewhere on the highway, causing companies downtime.

One solution to this situation is to expand existing and build new infrastructure. However, this is not always possible, for example in cities. Therefore, Intelligent Transport Systems (ITS) have been created, which can provide immediate information to transport participants and thus be able to maximize the use of existing infrastructure.

In the cities where IDS have been introduced, we are already seeing an improvement in the traffic situation. In Singapore, for example, where IDSs are developed at a high level, the average car speed on roads is 27 km / h, despite the fact that the population in Singapore has doubled since 1990. For comparison, in Jakarta it is 5 km / h. IDS thus bring an obvious improvement in the traffic situation and a number of benefits associated with it.

2. INTELLIGENT TRANSPORT SYSTEMS IN SLOVAKIA

In the territory of the Slovak Republic, the application of IDS began to be considered significantly later, only in the years 2002 to 2004, when the Ministry of Transport announced a state task entitled "Intelligent Transport Systems". From 2004 to 2007, Slovakia was part of the CONNECT project, in which the IDS architecture was designed to operate in Slovakia. The Government of the Slovak Republic decided to build the National Traffic Information System (NSDI) only in 2009. In 2010, the Ministry of Transport launched the NSDI pilot project in Trnava. This project still monitors traffic and transmits online data to a central server where they are evaluated. Part of this project was also the preparation of legislation, the result of which is the Act on the National Traffic Information System (NSDI).

How do IDS deal with transport in the Slovak Republic

As already mentioned, one of the biggest trends in transport in Slovakia, but also in developed countries, represents an increase in road transport. This fact has several negative effects on transport. As for the Slovak Republic, it faces many transport problems in this context and needs to address the following areas[1-3]:

- improve road safety and the protection of all road users
- prevent the formation of traffic jams, which increase travel costs and prolong travel time
- reduce the degradation of public transport
- reduce the negative impact on the environment
- improve the competitiveness and performance of freight transport and logistics systems
- to ensure that the inhabitants of the Slovak Republic have access to safe and accessible transport

In solving the mentioned problems, it is necessary to use new technologies that help in the introduction of progressive applications into transport. Intelligent transport systems are considered to be a key element of comprehensive solutions aimed at [10]:

- increase the safety of the transport process, - increase the efficiency and quality of transport expressed by saving time for transport,
- reduce negative impacts on the environment and reduce the energy intensity of transport, -
- improve the productivity of commercial activities of entities involved in the transport process,
- increase access to traffic information of individual subjects of the traffic-transport process for their rational decision-making, -

- increase the quality of transport infrastructure and reduce the costs of building new transport infrastructure.

3. CONCLUSION AND DISCUSSION

Intelligent transport systems are systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management, as well as interfaces with other modes of transport. The mission is to create a system that improves transport through the safe and efficient movement of people, goods and information with greater efficiency and less burden on the environment. This system must serve the interests of government, individuals and society.

The main goal is to improve the transport market, more efficient transport processes and the provision of quality services, which is taken care of by transport policy.

In connection with the development of means of transport, as well as their properties, increasing transport performance and the constant growth of the number of means of transport on the roads, it is necessary to adjust the technical parameters in the transport infrastructure and gradually modernize it. Nowadays, the biggest problem is the insufficient permeability of traffic flows. An alternative option would be to further expand the infrastructure, but this is not possible in some parts, especially in cities, and the construction of new transport infrastructures is costly. For this reason, new solutions are being sought that are able to optimize the transport system to make it more efficient, effective and safer. In particular, new technological tools are used for this, which meet the requirements of environmental and financially sustainable development of transport. One such tool is Intelligent Transport Systems (ITS), which is an important tool for traffic management and regulation. [2]

Higher safety for drivers and pedestrians

IDS brings important security benefits. Millions of people around the world die on the road every year. Applications that help reduce road mortality include an intersection that activates in the event of an accident and glows green as long as ambulances or fire trucks pass, a lane departure warning system or anti-skid system. IDS differs from current safety technologies mainly in that they help prevent accidents, while the technologies available so far have been designed to protect passengers in the event of an accident, such as airbags or seat belts. Most used applications [6-9]:

- Exception detection and warning systems
- Systems for faster response to rescue operations
- Camera systems to force the change of speed and light signals
- Anti-collision systems
- Automatic control of pedestrian and bicycle traffic

Improving the operational performance of the transport network

ITS improves the performance of a country's transport network by maximizing the capacity of existing infrastructure, which reduces the need to build additional lanes. For example, between 1980 and 2006, the total mileage in the United States increased by 97%, while at the same time, current highways expanded by only 4.4%. IDS applications contribute to improving the performance of the transport network. For example, signal lights increase the flow of traffic and reduce the risk of traffic stopping. This results in fuel savings and reduced air emissions. Electronic toll collection also improves traffic flow, as cars are not waiting to pay in convoys. Reducing congestion is one of the main benefits of IDS. The average American employee spends 5 days a year in traffic jams, resulting in the loss of 2.8 billion gallons of fuel a year. The US Department of Transportation has calculated that congestion costs the US economy $ 168 billion a year. As far as Europe is concerned, 24% of driving time is spent by the average European in traffic jams. It was found that in the cities in South Korea that deployed IDS, the average vehicle speed increased by 20% and the residence time at intersections decreased by 39%. The figure below shows how much the constipation of US citizens costs each year and what the expected development is for the future. Most used applications [1-10]:

- Adaptive speed control for undisturbed traffic flow
- Demand management: electronic payment, access control to the transport network
- Efficiency of the transport network: general traffic management, traffic flow management, regulation of access roads, detection of exceptional phenomena and their management, provision of information to the driver.
- Recommendation to change the mode of transport: preference for public transport.
- Automatic vehicle location
- Automatic tracking of freight transport
- Computer-controlled control
- Fleet operation management
- Driver monitoring
- Electronic collection of fees

Increasing mobility and comfort

IDS increase driver mobility and comfort by reducing congestion and maximizing the operational efficiency of the transport system, providing real-time information to drivers, allowing them to optimize the selection of the best possible route. Probably the best known IDS applications are telematics applications, which provide real-time information to the driver either in the car or before departure, so that he can plan the best possible route [4-8].

- Most used applications:
- Real-time traffic information
- Dynamic guidance of the vehicle to the destination
- Tracking of security or rescue vehicles
- Real-time transit information
- Payment by magnetic / chip cards in public transport.

Environmental benefits

The environmental benefits that IDS brings are the less need to build new lanes, as IDS helps make traffic more fluid by driving motorists. They also help reduce air emissions. A car traveling at 60 km / h emits 40% less CO2 into the air than a car traveling at 20 km / h. Some vehicles are equipped with eco-driving. This application optimizes driving behavior for the benefit of the environment. Vehicles with this application provide feedback to motorists on how to drive their car at the most economical speed across all driving situations [1-9]. Most used applications:

- Strategic demand management

- Management of access to highly concentrated communication network points
- Monitoring of air pollution
- Air quality information

Increasing productivity, economic growth and jobs

ITS also contributes to increased productivity, economic growth and employment growth. Improving the performance of the transport system ensures that people and products reach their destination as quickly and efficiently as possible, which increases the productivity of workers and businesses and increases the country's competitiveness. They also help reduce the cost of accidents and the loss of life. It is estimated that IDS could create up to 600,000 new jobs worldwide in the next 20 years. Studies in the UK say that a € 5 billion investment in ITS in the UK would support around 188,500 new or retained jobs in one year. Countries that support ITS are creating a competitive advantage. [3]

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REFERENCES

[1] ***Intelligent transportation system.*** Available: https://en.wikipedia.org/wiki/Intelligent_transportation_system
[2] Logistic monitor: ***Benefits and concept of Intelligent Transport Systems as a tool for traffic management and regulation within the Slovak Republic.*** (Logistický monitor: Prínosy a koncepcia Inteligentných dopravných systémov ako nástroja riadenia a regulovania dopravy v rámci SR) [online]. ISSN 1336-5851.
[3] Available: http://www.scag.ca.gov/programs/Pages/ArchitectureElements.aspx
[4] KALAŠOVÁ, A.: ***Introduction to transport telematics.*** In: EZELL, Stephnen. ITIF: Intelligent Transportation Systems [online]. Washington, DC, 2010, s. 5. Available: http://www.fce.vutbr.cz/PKO/holcner.p/5M3/4_Kalasova_ZU.pdf
[5] Toyota Global Site. Technology File [online]. Available: http://www.toyotaglobal.com/innovation/safety_technology/safety_technology/technology_file/active/
[6] ***Road-Transport*** [online]. Available: http://ec.europa.eu/transport/themes/its/road/index_en.htm
[7] ***Snapdragon Automotive Solutions: connected car platforms for all types of vehicle communications.*** Qualcomm [online]. Available: https://www.qualcomm.com/news/snapdragon/2015/06/04/snapdragon-automotive-solutions-connected-car-platforms-all-types-vehicle
[8] ***Grand Challenges for Control*** [online]. Available: http://www.ieeecss.org/sites/ieeecss.org/files/documents/IoCT-Part4-13VehicleToVehicle-HR.pdf
[9] ***Traintic - Rail Industry Intelligent Transport Systems (ITS) - Railway Technology*** [online]. Available: view-source: www.railwatechnology.com/contractors/computer/traintic

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