RESULTANT AND DIFFICULTIES OF IMPLEMENTATION OF INTELLIGENT TRANSPORTATION SYSTEM

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SUMMARY

The improvements of the road network are behind the demands of Hungary and of the connecting regions. And it means the significant growth of travel times, harmful environmental effects and the number of the accidents will be raised dramatically. Because the designed developments are only partly located on the areas with high traffic demand, the traffic problems of these regions should be handled by the implementation of intelligent transportation systems. But at these types of investigations the main problem is the lack of sources in case of public sector and the return of the benefits to the investor from the road users in case of the private sector, because without it the private sector is not interested in these type of implementations.

Keywords: intelligent system on motorways, TERN

1. INTRODUCTION

1.1. Current traffic situation

The Hungarian road network consists of a 30000 km in length national road network and a 75000 km in length local road network. The density of it is sufficient, however the structure of the road network involves two problems:

- there is not enough motorway
- the road network has a radial structure because of the capital centralization (2 million habitants live in Budapest from the 10 million habitants of Hungary), so Budapest has a lot of transit traffic.

The passenger car degree of supply is 250 pc per thousand habitants. In the traffic operation the ratio of the international transit traffic is significant because of the location of the country.

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1.2. Forecasted situation

Two significant changes should be mentioned among the changes expectable in the future. One of them is the growth of the number of vehicles (333 pc per thousand habitants in 2010, which is 1.5 times the current value, so very large). The second one is the acceleration of the motorway building, which means the realization of 120 km motorway and 265 km autoroute till 2007.

2. EUROPEAN POLICIES

Hungary is located in the middle of Europe. This country has a very strategical role in the Europe/wide transportation. Furthermore Hungary is one of the countries, which will be member of the European Committee in the near future. So at the development of the Hungarian transportation networks the European policies have to be taken into account.

The Trans European Road Network (TERN) has been created in 1992 in Maastricht. This means the main traffic corridors and roads of the Europe-wide transportation. The European policies handle traffic management systems as the part of the TERN. This is very important from the point of view of Hungary, because our motorway network connects to the TERN, and after joining to the EU it will be a part of the TERN. So it is elementary need to apply traffic management systems on our motorway network for realizing the same services on the Hungarian motorway network as on the motorways of TERN.

The benefits of the application of telematics systems are the following:

- maximal usage of capacity of the existing transportation infrastructures (primarily in road and railway transportation) with increasing of capacity with 15-30 % in the low-capacity cross-sections
- realization of the most effective modal split which means the preferation of public transportation against individual one in the urban regions and the preferation of railway or water transportation against road transportation in long distance transportation
- decreasing of harmful environmental effects caused by transportation
- realization of benefits of usage of transportation infrastructure according to the aspects of economy
- influence of traffic demands
- increasing traffic safety by application of intelligent transportation infrastructure and the intelligent vehicle.

The application of telematics is expected to contribute to significantly reducing the traffic problems, especially in case of the followings:

- integration of different transportation modes into one common system
- effective usage of the infrastructure connecting to different transportation modes
- possible reduce of traffic demands or distributing of traffic demand to other, more environmental-friend by transportation modes
- increase of traffic safety and decrease of environmental effects.

The followings are suggested for the minimal services applied on the motorways of TERN:

- The minimal services should fulfill the substantial requirements could be reached by all road users.
- The application of a given system is determined by the quality and continuity of the service.
- The basic service has two components: the individual one regards the optimalization of the travel time of the road user, while the collective one regards the optimalization of the facility for number of users. These latter services are qualified by the aspects of safety, undisturbed traffic operation and comfort.

The majority of EU countries and some private organization have signed a treaty (Memorandum of Understanding, MoU, 1997) about unified data transmissions which make possible the data exchange between traffic operation centers and across borders. This treaty substantially contributes the interoperability of the existing or future telematic systems.

The network of traffic and travel centers and the border crossing electronical data exchange among these centers - especially along the TERN - are important for the qualified traffic management, safety and information services and for the development of Europe-wide market of traffic and information services.

The MoU has two level approaches: from one side it is on a European level, from the other side it appears on the operation level of the affected traffic centers as well. The model is built on the technological and organizational solution applied in DATEX-Net specification.

The realization of basic service of level means that the road users can get the basic information along the European motorway network, and the tools should be usable independently from the countries. Primarily the application of traffic control systems which assures effective traffic operation, and of RDS-TMC and vehicle navigation systems which inform the road users, are necessary.

3. HUNGARIAN PROJECTS

3.1 Preliminaries

The connection of the Hungarian motorway network to the European one means not only building motorways but also the realization of intelligent motorways. The intelligent motorways have to assure the basic services and have to be able to be extended in the future according to the demands.

In Hungary the first steps towards the application of intelligent transportation systems were made by the Budapest University of Technology, Department of Highway and Traffic Engineering. The Department has made some feasibility studies about the implementation of intelligent systems, and has made some suggestions where they are the most important in Hungary. All the intelligent projects have been initialized by the Department.

In 1997 a study called "The intelligent transportation information system in Hungary" (IKIR) was made with the support of Trade and Development Association (TDA) of United States of America. The Intelligent Road Information system worked out in the frame of the feasibility study could be the base of the integration of the future telematic systems.

The primary purpose is the co-ordination of development of an extended Intelligent Transportation Information System in Hungary. This system would increase the effectiveness and safety of the operation of the national road network. The IKIR would build on the already existing projects and would assure a leading position at development of a European system based on the similar program of several countries. The main purposes of IKIR are the followings:

- Real-time information for the road users and road operators in Hungary,
- Co-ordination of functions regarding IKIR in the frame of Ministry of Transportation, Telecommunication and Water Management,
- Promotion of co-operation with private companies for accelerating the financing of IKIR,
- Increase of traffic safety and of effectiveness of operation on behalf of the road users in Hungary,
- Development of a national system compatible with the extending European intelligent traffic information system,
- Creation of communication systems and computer programs necessary for the above mentioned purposes.

IKIR includes three different processes, which are:

- information
- decision making
- measures, arrangements

The measures regard for the following four components of operation:

- real-time information
- traffic control and monitoring of motorways
- traffic control of road network of counties
- co-ordination of existing traffic activities

3.2. Description of projects

The first traffic control system using VMS panels was implemented on the Érd hill of M7 motorway as a trial section in 1988. The purpose of the congestion warning system was the forecast of congestions - formed because of the traffic overloading and the lack of the climbing lane - or avoiding congestions by harmonizing the vehicle speeds in the weekend traffic towards Budapest.

A study was made in 1993 for the information and traffic management system of M0 motorway and the connecting road network. After this system plans and feasibility studies were made for the other motorways and for the road network of Budapest

regarding collective dynamical information and traffic control systems. The most important projects are described in the following subchapters.

3.2.1. MARABU

The system plan and the detailed building plan of MARABU (**Ma**nagement of the **R**oad Traffic **a**round **Bu**dapest) information and traffic control system were made in 1993-94 for the M0 motorway and for the connecting motorways and minor roads. The main goal of the planned system is strengthening of the traffic sharing role of the M0 motorway ring, optimal usage of the capacity of the road network around Budapest and assuring undisturbed, safe traffic operation on the affected road network. The architecture of MARABU system makes possible the realization in more (spatial and time) step, because the subsystems can work independently from each other.

MARABU includes the following subsystems:

1. Surveillance
2. MARABU center
3. Weather warning system
4. Roadside information system on M0 motorway
5. Roadside information system on the urban road network connecting to the M0 motorway
6. Roadside information system on M1 and M7 motorways
7. Roadside information system on M1-M7 motorway
8. Parking information system (for P+R facilities)
9. Linear traffic control system on M1-M7 motorway
10. Linear traffic control system on M7 motorway

The MARABU information and traffic control system would make possible the data collection for before and after examinations, the analysis of results (decrease of accidents, decrease of environmental pollution effect of road traffic, decrease of travel costs and delays, etc.) come from the information and traffic control systems. This is a new system because such results are available for us only from literature or based on systems operated in another countries.

3.2.2. MAESTRO

The MAESTRO system manages the traffic operation on M3 motorway and the alternative road network. Its architecture makes possible the implementation in several steps. In first step the system operates as a regional traffic management system which could be supplemented with a linear control system in the future. The system is divided into more spatial part as well. The first one is the section between M0 motorway and village Bag. The building of this section was finished in the summer of 1998.

This first section is a trial section as well, because the traffic control system could be checked first here in the practice. In the future the system will be built together with the further building of the motorway. The road users are informed by VMS panels located in the intersections.

MAESTRO consists the following subsystems:

- Traffic data collection
- Meteorological data collection
- Data evaluation and control subsystem
- Information subsystem

3.2.3. MONARCHY

The MONARCHY traffic management system manages the freeway network of the western part of Hungary and the Austrian-Hungarian border area. It connects to the information system of the border stations. Its purpose the maintenance of the safe and quick traffic operation, handling the traffic disturbances, the most effective usage of the road network of the region. It is a regional management system, which could be supplemented to a linear one if it is necessary. The road users are informed by VMS panels located in the intersections. MONARCHY consists similar subsystems as MARABU.

3.2.4. CITYDRIVE

Nowadays the agglomeration of the capital has the highest traffic, so the effective usage of the existing road network is the most important here. The suggested traffic management and control system for this area is called CITYDRIVE.

This system would be built as part of the countrywide traffic management system. Its main purposes in the first time are giving information to the road users and dividing the traffic demands among the main road network entering into Budapest. In the future it will manage the main road network in the region of Budapest, in co-operation with the countrywide operation centers. This system includes some of the above mentioned systems (MARABU, MAESTRO) as a subsystems. The components of the managed road network are the following: M0, M1, M3, M5, M7 motorways and main roads nr. 100, 10, 11, 2, 20, 30, 31, 311, 4, 40, 50, 41, 510, 6 and 70.

3.2.5. Individual information systems

The basic conditions of the individual information systems are given in Hungary. Some subsystem already works as a pilot project.

As the first step of services through GMS network, the subscribers can get information about the actual accidents in Budapest.

A pre-trip information system works in Budapest. This system communicates with the road users through touch information terminals or computer networks.

3.2.6. Countrywide operation center

According to IKIR the intelligent traffic management has two levels in Hungary. The first level contains the local management systems, and the second level is the

countrywide operational center, which co-ordinates the operation of the local systems. Its tasks are the followings:

- multipurpose usage of the given technological components
- creation of common data bases
- connection of different traffic control measures
- integrated strategy

3.3. Organizational frames of telematic projects

The implementation and operation of telematic projects requires partnership frames between the public and the private organizations which frame satisfy both parties' demands. On the area of traffic control and information system there are systems, which should be operated unanimously by public organizations and there are systems which one's services belongs to the private sector. On those areas where the claims of the two parties overlap each other, the frames of the Public-Private Partnership should be created. This partnership promotes the effective implementation and operation of telematic systems.

In Hungary first the background of application of telematics in transportation should be created. Unfortunately the road administration does not trust in the wide possibilities and advantages of application of telematics, and it takes no notice of the meaning of precedent - primarily connecting to the private sector - of the modern electronical technologies in the country.

The road administration has to answer the following questions:

- What is the role of the road administration in the development process of transportation electronics?
- How should the road administration influence the above mentioned process?
    - It should follow the development with attention only - for avoiding the non-wanted side effects -, and the conditions will be determined according to this by policies regulations and laws, or
    - The road administration should actuate and co-ordinate the development of transportation electronics, supporting the application fields which ones has significant benefits, actively participating in the process of research as well, taking some financial risk upon itself.

In our case the only possibility that the road administration takes the coordinating role in the application of telematics. Because in this way it can determine the margin conditions, can avoid the non-wanted side effects, can turn the benefits of telematics to its own advantage and can integrate the services of private sector into its own operating systems.

4. CONCLUSIONS

Nowadays implementation of intelligent transportation system is on of the most important projects. With it the traffic problems could be reduced, the effectiveness of the road network and the traffic safety could be increased and the harmful environmental

effects could be decreased. And the cost-benefit ratios of these types of implementation are very good. That is why on TERN the minimal services for road users have been defined.

If Hungary wants a modern transportation system, beyond completing the motorway network we have to realize the basic telematic systems as well along our motorway network. Furthermore we have to reduce the traffic problems of overloaded areas such as Budapest. These could be done effectively by application of telematic systems.

But for starting these projects first the organization background should be created. Nowadays the road administration has not recognized yet the importance of intelligent traffic management systems. The Budapest University of Technology tries to implement the systems, making feasibility studies and searching investors. The first building intelligent system (MAESTRO) is the result of these efforts. But it is very important that the road administration recognize its role in the implementations, because it is indispensable for creating the organizational background. And when the frames and partnership models are existing, finding interested parties for application of telematics will be easier.

So we are at the beginning of a long road. In this situation we have to create the partnership models, and have to prove to the administration that these systems are worth to implement. The Budapest University of Technology has started this way, and as we see, we managed to take the first, most difficult steps.

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