Concept of implementation complex ITS solutions in Eastern European countries
(Latvian view)

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Introduction
Development of Intelligent Transportation System (ITS) as a scope of related elements, subsystems and their further integration is not obvious and difficult task for road authorities, although now, it becomes necessary for maintaining mobility on highly trafficked roads.

In comparison with traditional road assets, such as pavement, structures, signs etc., which are mostly of solid functional matter with experienced and fairly predictable aspects of service life and corresponding costs, ITS elements are quite different. Their performance is smart, namely: relational and mainly based on IT and communication technologies. Therefore, long term cost effective ITS need to have clear measurable goals, high range of automation and “opened” architecture, so to be flexible for expansion, upgrade and integration.

Notwithstanding wide range of ITS solutions, they functionally lie mainly in four major groups, concerning legislative mandate of road authorities:

• traffic related data gathering;
• dissemination of traffic information to road users;
• adaptive traffic management;
• access management.

There are some features, which make quite distinctive ITS goals in urban and rural areas, as well as for public and toll roads, which is reflected in their specific structure and elements. This proceeding describes in detail current situation and objectives of ITS in Latvia, as well as contains conceptual milestones of national ITS development.

Present situation
Many EU new member states now are faced with global economical crisis, which is expressed hardly here than in Western Europe, due to of lack of previously accumulated resources. That means significant budget cutting measures also in road sector, and subsequently, in ITS. From the other side, the period of economical decrease is reflected in stabilization or even considerable fall of road traffic, and some related problems (for example, traffic jams), which are positioned to be solved with ITS tools, become not so actual in such periods.

Usually, transport authorities of EU new member states objectively focus their efforts on such priorities as well-weread road asset management and administrative measures (charging schemes, technical requirements for vehicles and so on) with limited resources, but ITS idea has no sufficient support. This situation is characterized with the next factors:

• there are only some pilot ITS implementations without clear overall development strategy;
• there is no previous technological experience in the field of complex ITS solutions;
• there is low level of road staff and overall society awareness about aspects of ITS;
• ITS projects are announced, where corresponding acute problems still exist, not in advance.

So, ITS projects may start as a pretty vision or a tool for a concrete situation, but faced with many technical and technological problems, restrictions and lack of knowledge to solve them in a process, have completed on lower levels, than was estimated before. In many cases, classic and well known ITS solutions from the Western Europe here are too expensive. Moreover they are partly based on obsolete IT technologies, because of gradual these ITS development in recent decades, and copy-paste principle here is not adequate. From the other
part, there are no possibilities for in depth research programs and ITS consumers need to be oriented on “ready to use” solutions.

**Guidelines for ITS development**

As marked above, wide coverage, long term and cost effective ITS development is quite difficult task for road authorities of Eastern European countries. The cornerstone of it will be proper use of existing opportunities, related to actual needs. One of the ITS implementation guidelines here is maximal orientation on widespread “light” technologies (satellite navigation, wireless data transfer, existing and still widely used customer interfaces), which can make a reasonable ITS gap, without massive investments due to wiring, extensive roadside telematics, traffic management centers and other real infrastructure. In such way, road sensors, used in ITS subsystems, need to be as multifunctional as possible. An accent will be lie on implicit sensing technology here, which let to capture primary data and their derivatives (for instance: videoimage $\rightarrow$ traffic flow $\rightarrow$ commands to telematic devices).

Other direction is in-depth public private partnership in ITS field, when public authorities provide only necessary framework (widening of road monitoring systems for traffic related data gathering and public access to them, pricing and collaboration schemes ect.), but service provision to road users should be developed by commercial enterprises.

![Figure 1. Principles and planned timeline for ITS development in EU (EasyWay vision)](image)

Among other opportunities, EU commission’s initiative to harmonize ITS field on EU scale through number of programs is a good platform to experience transfer, establishing of international services, technical standardization, as well as possibilities of external fundings for ITS projects. The major of this program, with clear customer orientation, is EasyWay, which involves consultative support and allocations for ITS projects in all EU member states (Figure 1.). Participation in such international projects lead to more effective decision making in ITS field on national level.

Concerning “smart” systems, an adequate principle of their deployment is “step by step” for significant mistakes avoiding, by what ITS pilot projects starts with small budget, to work off acceptable solutions for following large-scale investment projects. This approach is in force also for Latvian State road network’s ITS.
Concept of Latvian state road network’s ITS

Latvian state roads consist of a network of primary interurban and rural routes, which is under responsibility of SJSC “Latvian State roads” (LSR). This network is about 20000km. long, where main roads are 1647km. (traffic from 5000 to 35000 vehicles per day), regional roads are 5300km., but local roads are about 13200km. Overall needs of ITS here can be formulated as followed:

- only main roads need to be equipped with constant road monitoring systems according to existing traffic pattern;
- traffic information (restrictions, roadworks, traffic jams, alarms, road condition in winter ect.) need to be publicly accessible for all state road network;
- adaptive traffic management (by improvement in the system of existing traffic lights) is clearly needed only for some knots around the Riga city on ringroad and on corresponding radial stretches of other main roads (Figure 2.);
- electronic queue control and corresponding services for commercial transport on Latvian – Russian border crossings.

ITS tolling applications are not actual in Latvia, because here are no and in the nearest future are not planned toll roads. Till 2005. only RWIS was gradually developed for the need of road winter maintenance with public interface (balticroads.net). Other systems (traffic counters, road databases and so on) up this time were developed and used only for technical planning of road network.

Traffic information centre (TIC) as a unit of LSR road maintenance department was established in autumn of 2005., with aim to be the central part of further full range ITS (Figure 3.). TIC located in Riga’s satellite city Ogre, and is planned to perform also certain traffic management tasks in future, so to provide common TIC/TMC functionality. At
present, main TIC’s function is to be a united link between various sources of traffic related data twenty four hours, to:

- provide generalization and accessibility of traffic information for society;
- deal with consultative support of road users on demand (hotline);
- negotiate between road authorities, emergencies and road users for fast elimination of dangerous traffic situations;
- ensure adaptive traffic management regime for some one-level intersections near Riga, regulated with traffic lights (up to 2010.)

Figure 3. Functional scheme of ITS for Latvian state road network
It is clear, concerning the performance of TIC/TMC, functions of informative flow and traffic management need quite different, but integrated approach (Figure 4.). The first is more relational and up to some acceptable level it is based mainly on organizational aspects (can be realized in beginning phase of development), but the other is absolutely discrete, more technically sophisticated and need high range of internal automation of ITS.

Accordingly to the functional scheme, the next key facet of ITS is technological orientation. Due to abovementioned reasons, in situation, when development is uneven and ITS related modules come from different parties, proper approach seems to orientate it on “opened” nor proprietary solutions (Figure 5.).

Now, the most critical point here is data transfer between roadside equipment and TIC/TMC, which restricts ITS scope, because of lack of broadband channels to be effectively used for online services. This is reflected in fact, that there is no dedicated IT network (fiber optics) along roadside, but existing wireless channels of high capacity (3G, CDMA) have poor coverage in rural area or are unacceptable by costs. Therefore, now, road monitoring systems are mainly based on wireless data package principle (GPRS), but stretches of intended adaptive traffic management will be provided for continuous data flow by locally mixed schemes (radiolink+wireline).

Other important question is dealing with ITS data, which need to be acceptable for other systems, as a category of geographically oriented public metadata, as well as external data import to ITS. Now, LSR is working on a creation of overall road database, where will be merged geographical, road and traffic data and their analysis tools on the one platform. After that, corresponding road metadata should be accessible through national web portal of geospace (due to INSPIRE directive) and through other Latvian unified information systems (state’s e-management).

**Latest activities in ITS field**
LSR, faced with the need of comprehensive ITS model for rural road network, have to implement complex inexpensive solutions in 2008-2009, which are based on opportunities (using of existing equipment and outsourcing the services) in the following directions:

- introduction of multipurpose sensing knots on the base of existing RWIS (41 stations along main roads), by adding road video surveillance equipment;
- automation of 22 stationary traffic counters for gathering online traffic data from them in addition of common traffic statistics;
- dissemination of interactive traffic information through personal devices (vehicles navigators, mobile phones, RDS receivers), by involving commercial partners, specialized in this field (the first implementation will start in summer of 2009.);
- creation of professional web meteorological service, were many data categories (RWIS, video images, numerological forecasts, warnings, data from weather radar and satellites) are collected for decision making support in road winter maintenance;
- working with emergencies on “e-call” service provision in Latvia;
- creation of national traffic information web resource (www.celugids.lv, road guide).

Now, most activities lie in the field of traffic information dissemination. Road authorities try to publish as more traffic related data and as wider as possible, providing their accessibility for society. In its turn, LSR displays traffic related data in web pages www.celugids.lv and www.lvceli.lv (enterprise’s home page) as actual announcements and links to interfaces of road monitoring systems. Some kinds of regular announcements (road condition in winter, roadworks) also are spread through media (news agencies, web portals and radiostations). These are pre-trip services, which people can looking for before the journey. But only on-trip approach can give real-time, interactive (direct feedback to authority) and geographically, as well as, route oriented traffic information, which and can perform some kind of virtual traffic management, if the significant part of users are involved (Figure 6.).

Figure 6. Evolution of traffic information services

A concept of such a wide range public on-trip service is shown below (Figure 7.). Here is needed in-depth technological collaboration between parties, which gather related information and can provide it to users from unified platform (it can be national web portal of geospace). Data will be accessible for free on user’s devices through SMS/MMS and RDS-TMC through corresponding protocols. The second phase, an addition of floating car data...
(FCD) module, as a kind of mobile traffic sensing on network’s scale will be proper for urban and interurban stretches. The other use of FCD is related to marking of places where road maintenance is performed. Now, vehicles for winterworks on main roads are equipped with automatical registration of performed job and have other functions of common fleet management system, so, activity’s status of such vehicle can generate corresponding dynamic warning for on-trip services.

Taking into account a fact, that usually customer services are effectively provided by market, more proper alternative is collaboration with commercial media partners, having ready technologies for that and interested in wider coverage of their services. This approach let also to minimize implementation time and costs. The first commercial operator, which will broadcast its on-trip traffic information service in Latvia is Destia. LSR is opened to collaboration with other possible traffic information providers, to support enough coverage and competition of such services.

Figure 7. Concept of traffic information’s interactive dissemination as public service

Conclusions

As shown above, Latvian view on ITS development is practical, it is not to be some kind of fashion, but there will be clear cost effectiveness of implemented measures. Other is “step by step” principle, which minimizes risk of large-scale mistakes. Gradual awareness of needs and external framework (legislative and technological), let to define major process and to work out functional scheme of ITS, which will be realized by integrated corresponding services and will be effective on long-term basis.