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APPLICATION OF ICTs IN TRANSPORT PROCESS

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ABSTRACT:
The paper focuses on basic description of the transport telematics and intelligent transport systems from the point of information and communication technologies (ICT) -based safety technologies view. Present considerations are then confronted with EU directing as defined in the ITS Action Plan covering the period 2009 – 2014.
KEYWORDS:
ITS, ICT, road transport, telematics, eSafety

1. PROGRESSION OF TRANS-EUROPEAN TRAFFIC NETWORK

One of the first big traffic-operational concepts of the development of Europe at supranational level was "Blue Banana project", when besides EU member states Great Britain was also involved into the concept [1]. The arch was including strategic nodes – London, industrial intersection Belgium – north France – Holland, it was cumulating in west part of Germany – in Purina, where continually crossed into the Bavaria (Munich), Switzerland and through the west Austria. It finished in industrial agglomeration of north Italy (region of Turin and Milan) [2].

Political changes – admission of new member states into the EU in May of 2005 proposed theme of shifting the hub and connection of new agglomerations. It results into new concept under the name of „Red Octopus", whose central part lies in the area of Germany and from there branches into several arms [3]:

- South - west branch: Turin – Barcelona – Madrid,
- South branch: region Trento – Treviso – Raven – Rome,
- North branch: Hamburg – Copenhagen – Stockholm,
- North – east branch: Poznan – Warsaw – Vilnius.

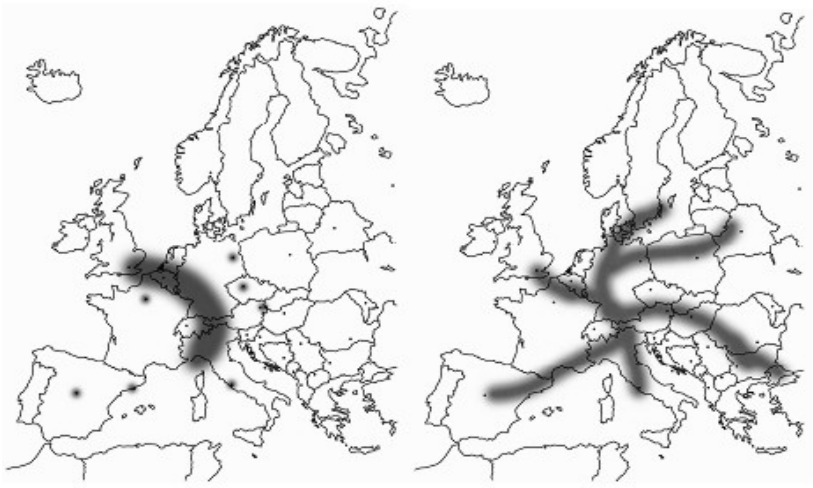

Figure 1. Blue Banana and Red Octopus

Both, concept of Blue Banana and Red Octopus are shown in the FIGURE 1.

With the concept construction of road infrastructure ergo also construction of tunnels in Slovak Republic, Czech Republic and in the Poland is apparently related. At the arterial road south-north and east-west in Slovakia is planned to be build 23 tunnels, in Czech Republic over 30 and in the Poland 10 tunnels which has to comply with requirements of European legislation [4].

2. TELEMATICS AND INTELLIGENT TRANSPORT SYSTEMS

Telematics is a systematic engineering field, dealing with creation and purpose-made utilization of information environments for homeostatic processes of territorial complexes, up to global field network.

Telematics results from convergence and subsequent combination of telecommunication technologies and informatics with support of management economy and mathematical methods for creation and control of complex systems. The effects of telematics is shown in wide spectrum of user area, from multimedia communication of individuals up to intelligent application and control of global network fields such as transport, connections and public administration.

Intelligent traffic system integrates information and telecommunication technologies into traffic engineering with support of other related subject fields (economics, traffic theory, etc.) so that increases traffic performance, safety and comfort of transport. Practically traffic telematics represents information and telecommunication support of traffic process. Detailed explanation can be found e.g. in [5].

Resent decades have also brought essential changes in safety approaches. Initially road users had to adapt themselves to the transport system (the Danish concept of sustainable safety, British programme of road safety, Swedish concept "vision zero" etc.). Present concepts are based on the concept of an inherently safe transport system which aims to prevent accidents. Severity of those accidents that cannot be avoided should be maximally minimized. Transport systems designed as inherently safe may also be characterised by integration of infrastructure, vehicles and regulation measures. Many European road transport systems will follow this concept during next 30 years. Different ITS technologies will be established as elements of these systems. Their effects on safety may be impressed by the planned traffic process (operation of the road traffic equipment) or its deviation. Both factors should be considered even before deployment of ITS into an inherently safe transport system [4].

ITS should guarantee the required safety level of processes and information; time, economic and energetic efficiency of processes; non-endangering of environment (tolerable risk level); and commercial effectiveness for transport-oriented business entities.

In addition to general system characteristics ITSs have many other significant properties (temporality, ca*usality, dynamics, safety, risks, mechanisms used to minimize risk etc.).*

3. ICT-BASED SAFETY TECHNOLOGIES

Increasing capacity and flexibility of ICT together with decreasing investment and operation costs makes possible real development of cooperative systems. If traffic means communicate with one another and/or with infrastructure, quality of information related to vehicle position, velocity, weather conditions etc. increases. ICTs are considerably connected to many kinds of mobility, especially those related to traffic means. Development of high-performance processors, sensors and actuators bring new ITS-based functions to vehicle driving and monitoring. New ICTs are applied in intelligent systems of active and passive safety, next generation of advanced systems of driver assistance and cooperative systems car-to-car (C2C) and car-to-infrastructure (C2I) - see FIGURE 2.

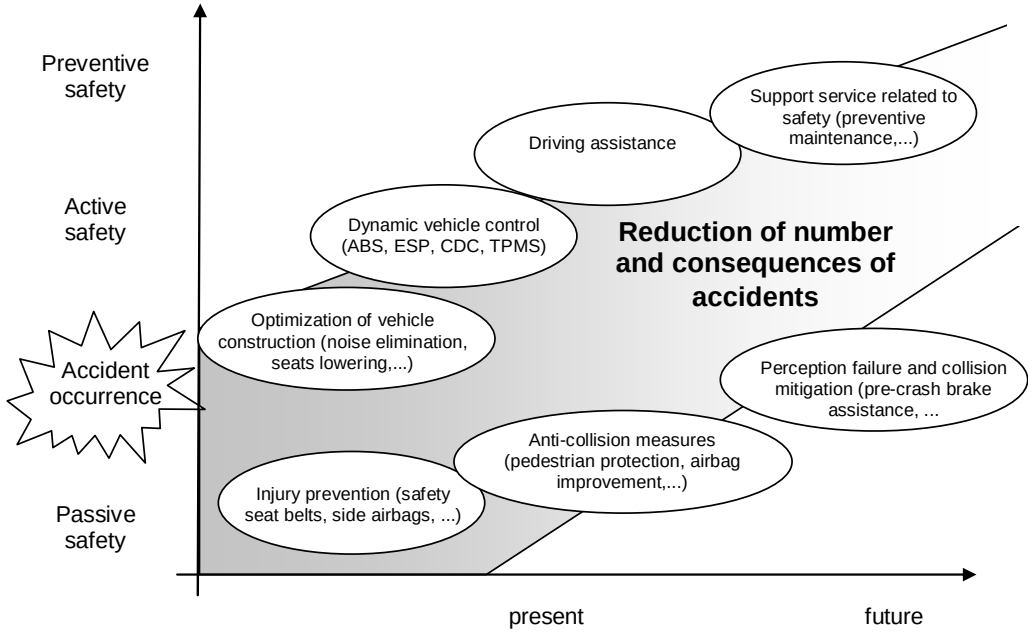

Figure 2. Assumed development of ict-based safety technologies

3.1. More intelligent vehicles, safer and more efficient mobility

ITSs promise safer and more efficient mobility. The primary effect of ICT in transport consists in enabling development of more intelligent vehicles, more sophisticated telematic services and improvement of ITS to be applied in traffic control and road infrastructure. Telematics and innovative logistics based on ICT are able to increase traffic flows by preventing congestions, even in the existing infrastructure.

More sophisticated telematic services. Telematics and ITS are stimulated by ICT development (usage of mobile communications, localisation - positioning technologies, smart sensors, actuators and interfaces, high-performance car processors, high-speed in-vehicle communication networks). The significant role is played by industry which brings new quality to personalized services and supported business models. Essential telematic services are: safety and security (containing eCall, vehicle monitoring, goods monitoring); vehicle-oriented telematics (including remote diagnostics and preventive maintenance); navigation and routing (including dynamic navigation, traffic information); and congestion management and infotainment (entertainment, access to Internet, information services, e-mail).

Mobile communication. Perspectives of mobile, localization and related services are clear and considerable, namely using the GPRS and UMTS that get into the car market. Range of provided services is growing thanks to ability to be permanently on-line and offered broader bands. In future the telematic services based on SMS or WAP messages will be substituted with extension of localization services utilizing GPRS/UMTS and Digital Audio Broadcast/ Digital Video Broadcast (DAB/ DVB) [2].

Logistics supported by ITS. Importance of combining logistics with ITSs in all transport domains and especially in road long-distance freight traffic is apparent. More and more ICTs are becoming used for route planning, vehicle and goods monitoring and with that associated invoicing, loading and unloading. Using ICTs, long distance haulers are able to manage their rolling stock. The role of ICTs in logistics grows together with electronic services associated with eCommerce and the trend of just-in-time delivery.

3.2. More intelligent infrastructure

Intelligent infrastructure and cooperative systems. Many large and medium large cities are equipped with progressive adaptive computer-based traffic management and information systems. Effective traffic management assumes availability of real-time traffic information. Traffic data is collected by conventional sensors being installed at critical sections of road networks, with wider use of video sensors and image processing methods. Wider usage of Float Vehicle Data can be seen too. Future advances in mobile communications; traffic management and ICTs will enable to avoid network bottlenecks. Cooperation between an intelligent infrastructure and intelligent vehicles will be valuable for both systems. Information on network conditions is necessary for improving in-vehicle system efficiency, feedback information is important for improving operator's knowledge.

Satellite system Galileo. This system will be a core of positioning technologies for telematic services. Localization information together with mobile communication makes possible increasing number of telematic services (eCall, in-vehicle navigation, Point of Interest services, vehicle monitoring, localization of stolen vehicles etc.).

3.3. ICT in telematic services

Services for drivers and travelers. They cover information on traffic roads, traffic links, information presented to drivers via information tables at highways and parking lots, dynamic traffic information provided via radio, TV or Internet, information sent to vehicle drivers via RDS and GPS, mobile operator services.

Services for infrastructure managers (traffic roads, traffic terminals). They monitor quality and conditions of the road network, manage infrastructure maintenance, monitor safety of traffic operation, etc.

Services for traffic operators. They concern choice of optimal routes, rolling stock circulation, vehicle maintenance, remote diagnostics of vehicles, delivery of spare parts, monitoring of driver's behaviour, etc.

Services for state and public administration. They realize connections of transport telematics to public information systems, and thus bring economic contributions thanks to better evidence or repressive measures (traffic violations, evidence of driving licenses, etc.).

Services for integrated emergency system. They contribute to better organization and coordination of rescue activities in case of accidents and catastrophes.

Services for financial and inspection institutions. They are mostly utilized by insurance and leasing companies and banks. Various discounts of insurance fees can be provided depending up a monitoring equipment installation (pagers, RFIDs), electronic identification of goods, monitoring and localization of stolen vehicles and goods, electronic fees for provided services, eBusiness in transport.

4. RECOMMENDATIONS FOR SECURE COMMUNICATION PROTOCOL

Standards adoption is most delayed in the field of data transmission and processing. This is mostly evident when moving from wire to wireless communication or communication via Internet.

Standardization activities should be strengthen especially in terms of security for communications via open communication systems where there is a need to define new security services [3]. Provisionally security standards defined for ICTs may be used. Selection of cryptographic mechanisms for safe/security protocols may be based both on existing standards and experience gained from the projects that tested cryptographic primitives against all known cryptographic attacks and collisions. Example of such a project is the European project NESSIE - New European Schemes for Signatures, Integrity and Encryption [6].

In addition to broadband communication there is also dedicated short-range communication that is mostly used in electronic toll collection systems, parking tolling, transmission of traveller information into vehicle etc. Traffic data is often transmitted using stationary terminals (phones, radio, TV, PC, Internet, fax) or mobile terminals (car radio, mobile radio station, pagers, transmission digital equipment). Well known is the Radio Data System – Traffic Message Channel (RDS-TMC), integrating all available traffic and traveller information so that a driver may optimize his/her route.

5. CONCLUSIONS

The paper shows that an effort made to improve safety, reliability and quality of transport services with the support of ICTs commands interest of the European Commission in research and realization of those intelligent transport systems that can meet increasing traffic requirements, reduce negative effects on environment and ensure safety of road traffic participants. Technical development in recent years has made creation and usage of integrated intelligent systems possible [5]. Theoretical knowledge and partial practical experience gained by experimental testing of new technologies (e.g. information system of integrated transport, multimedia tele-bridge, virtual integrated service system etc.) are already available.

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