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INFORMATION SYSTEM ON ROAD CONDITIONS IN CROATIA - PLANS OF DEVELOPMENT

ABSTRACT

The quality of information about road conditions in the Republic of Croatia do not meet the needs of their users - road vehicle motorists, regarding their content, updating criteria and timely announcement and warning of potential risks for the drivers. Neither do they meet the criteria of monitoring and support during poor traffic and weather conditions. The paper considers critically the current situation in the information system about the road conditions in the Republic of Croatia, and studies the reasons for such a condition. It also gives guidelines for improving the level of quality of this service and the plans for its development. It mentions the activities that should be carried out in order to improve the whole information system regarding upgrading of the current system in the segments of receiving and distributing information, application of new technical and technological solutions (GPS, RDS, TMC), development and improvement of the information and communication infrastructure, data exchange network, introduction of navigation systems, etc.

KEY WORDS

information, distribution of information, road conditions, HAK, GPS, RDS, TMC, navigation system

1. INTRODUCTION

1.1. The idea of informing

The idea of information in road traffic is regarded as ambiguous.

On the one hand, the motorist receives audio-visual information from single elements of the traffic system – vehicle, road, environment.

The skill of driving means that the motorist continuously receives information about the current situation in traffic and based on these makes decisions relevant to driving the motor vehicle.

Information about the road: carriageway condition, horizontal and vertical signalling, the condition of the vehicle (technical data, speed of travelling, vehicle accessories, etc.), the relation to other vehicles (position, travelling speed, handling procedures by other motorists), the relation to the environment (other roads, standing vehicles, pedestrians, facilities along the road, vegetation, etc.) are elements which influence the motorists' decisions.

On the other hand, special information centres inform the motorist about events and conditions of roads significant for the traffic. This paper deals with the latter type of informing.

Figure 1 – England – variable message signs

1.2. Needs of the user – the motorist

The needs of motorists determine the content of information and they expect:

- to have available updated information on traffic,
- to be warned on time of potential danger,
- to have support and assistance in unfavourable traffic and weather conditions,
- to have available recommendations on using the most suitable traffic routes,
- to have support and assistance in finding and reserving parking spaces, motel and hotel accommodation, garage and other services, etc.

Figure 2 – After determining the destination, Route Planner guides the user visually and vocally towards the set target

1.3. Content of information

The above mentioned expectations define the content of information relevant to the motorists, and they can be classified into several groups:

1. conditions, state and throughput capacity of roads and the condition in ferryboat traffic in Croatia,
2. traffic regime on border crossings with the neighbouring countries i.e. conditions, state and throughput capacity in the European countries,
3. recommendations on using the most suitable traffic routes in Croatia and abroad,
4. other information (prices of oil derivatives, road tolls, restrictions and bans for certain vehicle categories, prices and ferryboat timetables, parking, information on hotels, motels, restaurants, etc.).

1.3.1. Conditions, state and throughput capacity of roads and condition in ferryboat traffic in Croatia

In order to insure the above mentioned criteria of availability with updated information on traffic, the criterion of timely warning of potential dangers and the criterion of support and assistance in adverse traffic and weather conditions, it is necessary to continuously receive information on the following:

A Traffic regime

1. no restrictions or bans
2. ban on traffic for single vehicle categories
3. traffic according to a special regime (e.g. intermittent flow of vehicles)
4. traffic stopped for all vehicles
5. obligatory winter-driving equipment

B Traffic density

1. light traffic
2. increased traffic
3. queuing
4. standstills

C Weather conditions essential for the traffic

1. carriageway condition

- 1.1 dry
- 1.2 wet
- 1.3 carriageway flooded
- 1.4 landslides
- 1.5 ice in places or on certain sections
- 1.6 slush
- 1.7 trodden snow and ice
- 1.8 snow drifts

2. Wind and visibility

- 2.1 no wind
- 2.2 wind strength 60-100 km/h
- 2.3 stormy wind >100 km/h
- 2.4 good visibility
- 2.5 visibility <200 m (open roads)
- 2.6 visibility <100 m (inhabited area)

3. Precipitation

- 3.1 no precipitation
- 3.2 rain temperature >0 °C
- 3.3 rain temperature <0 °C
- 3.4 hail
- 3.5 strong shower
- 3.6 light snow
- 3.7 heavy snow
- 3.8 driving snow

D Emergency cases

1. traffic accident
2. heavy damage of carriageway or road facility
3. disturbance in ferryboat traffic
4. other events

2. CURRENT SITUATION

2.1. Mode of operation

Figure 3 – Information centre of the Croatian Touring Club (HAK) today

In November 1979, at the then Touring Club of Croatia, the first centre was established in the region of the former state, providing information on road conditions. Since then, 24 hours a day, 365 days in a year the motorists have had access to available information on roads condition and throughput capacity over mass media and special telephone lines.

As presented in Figure 4, the sources of information of the Croatian Touring Club today include: Croatian Roads Administration, County Road Administrations and the Ministry of Internal Affairs. The collected pieces of information are used to make collective reports on road conditions in Croatia, minimally three times a day (at 6 a.m., and 2 and 6 p.m.), and if necessary even more frequently. These reports are then proceeded to mass media, government bodies, and other interested subjects in the country and abroad. The same information is continuously broadcast over the radio, primarily on the second program of the Croatian radio, every hour. To broadcast this information the Croatian radio uses Radio Data System, i.e. a system which prompts the receiver in the car to automatically switch to the frequency broadcasting the news about traffic.

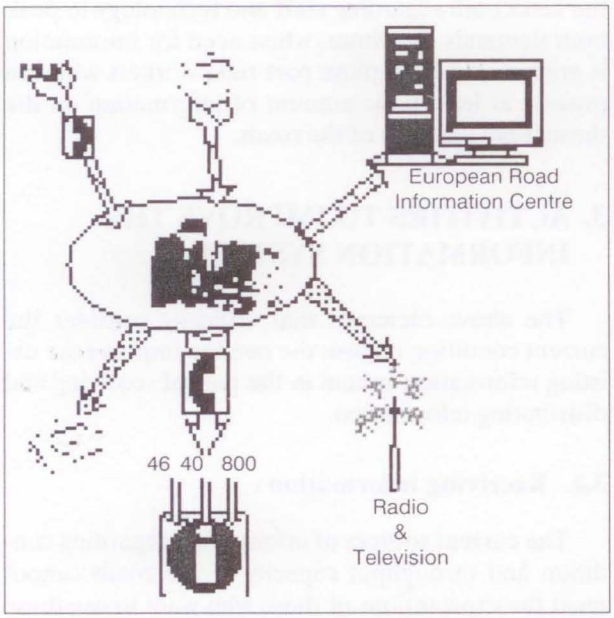


Figure 4 – Current state (organisation of reception and distribution of information in the HAK Information centre)

Apart from the second programme of the Croatian radio, HAK broadcasts information on traffic in the morning hours in the programmes of the majority of local and regional radio stations. During winter and summer, seasons in which such information is of more significance, they are broadcast in the Croatian television programmes, i.e. in the programmes of the regional and local television stations.

During summer, i.e. the tourist season, HAK broadcasts collective reports also in foreign languages – English, German and Italian.

Information on the condition and throughput capacity of the roads and the ferryboat traffic are available to users also through recorded messages system of the Croatian telecommunications at telephone number 060-520-520, teletext and HRT web pages, as well as over the phone 01/4640-800 (three successive numbers) in direct contact with the reporter on duty.

2.2. Legal regulations

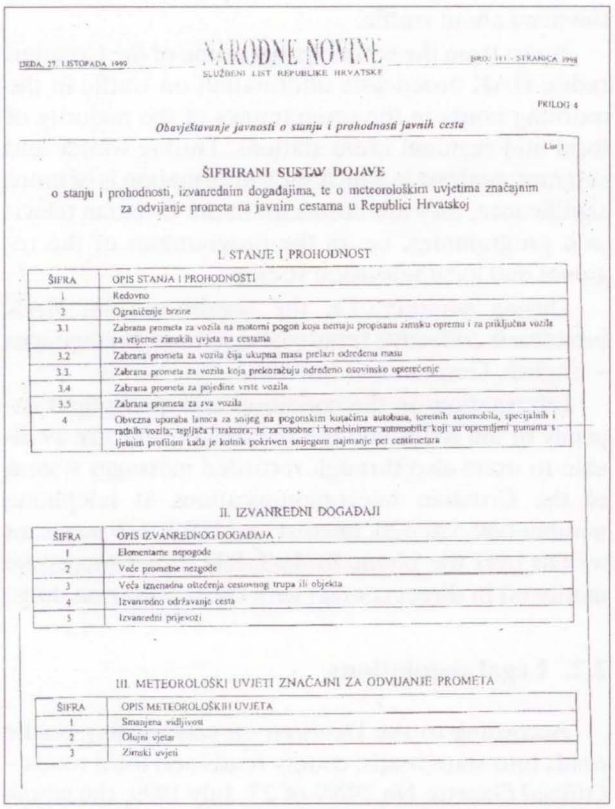
According to the Decision on categorising public roads into state roads, county roads and local roads – Official Gazette No.79/99 of 27. July 1999, the whole network of public roads has been classified into three groups: state roads, county and local roads. In December 1996, the Act on Public Roads came into force (NN 100/96) according to which Croatian Road Administration is authorised for managing state roads and the county and local roads come under the authority of the County Road Administrations.

In Article 14 of the Act on Public Roads, the maintenance tasks include also "informing the public about the conditions and throughput capacity of the public roads, about emergency situations and weather conditions which may affect traffic". Based on Article 31, Road Administration may "subcontract other legal bodies to perform these tasks".

Following these regulations, the Croatian Roads Administration and some of the County Road Administrations have signed adequate contracts with the Croatian Touring Club.

Based on the Regulations about maintenance and protection of public roads (Official Gazette No.

25/98) the Croatian Roads Administration defined the "Rules and technical conditions for patrolling the Public Roads" (NN No.111/99 of October 27, 1999). The system of informing the public about the conditions and throughput capacities is defined by Articles 29 – 31, the frequency of informing by Articles 32 – 36. The method of reporting and collecting information is defined in Articles 37 – 39, i.e. by the forms "Coded Reporting System" (Figure 5a) and "Collective Information" (Figure 5b).



NARODNE NOVINE
SLUŽBENI LIST REPUBLIKE HRVATSKE

PRILOG 4

Obavještavanje javnosti o stanju i prohodnosti javnih cesta

ŠIFRIRANI SUSTAV DOJAVE
o stanju i prohodnosti, izvanrednim događajima, te o meteorološkim uvjetima značajnim za odvijanje prometa na javnim cestama u Republici Hrvatskoj

I. STANJE I PROHODNOST

ŠIFRA	OPIS STANJA I PROHODNOSTI
1	Redovno
2	Ograničenje brzine
3.1	Zabrana prometa za vozila na motorni pogon koja nemaju propisanu zimsku opremu i za priključna vozila za vrijeme zimskih uvjeta na cestama
3.2	Zabrana prometa za vozila čija ukupna masa prelazi određenu masu
3.3.	Zabrana prometa za vozila koja prekoračuju određeno osovinsko opterećenje
3.4	Zabrana prometa za pojedine vrste vozila
3.5	Zabrana prometa za sva vozila
4	Obvezna uporaba lanca za snijeg na pogonskim kotačima autobusa, teretnih automobila, specijalnih i radnih vozila, teglača i traktora, te za osobne i kombinirane automobile koji su opremljeni gumama s ljetnim profilom kada je kolnik pokriven snijegom najmanje pet centimetara

II. IZVANREDNI DOGAĐAJI

ŠIFRA	OPIS IZVANREDNOG DOGAĐAJA
1	Elementarne nepogode
2	Veće prometne nezgode
3	Veća iznenadna oštećenja cestovnog trupa ili objekta
4	Izvanredno održavanje cesta
5	Izvanredni prijevozi

III. METEOROLOŠKI UVJETI ZNAČAJNI ZA ODVIJANJE PROMETA

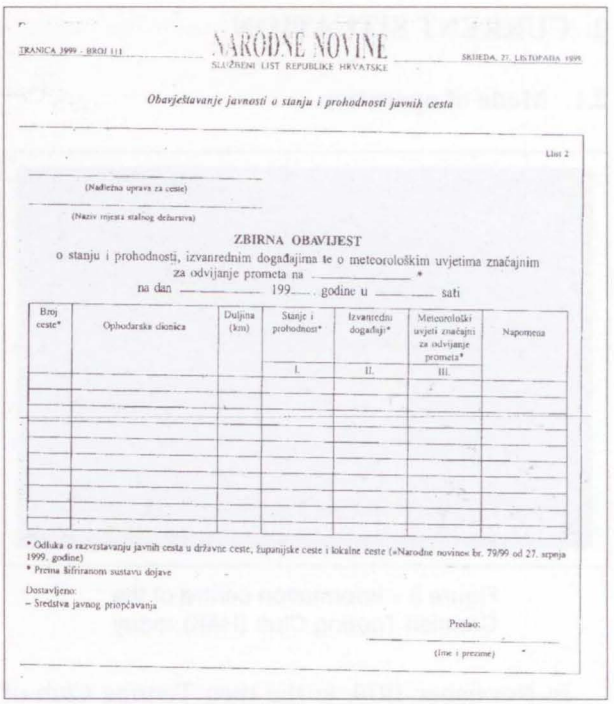
ŠIFRA	OPIS METEOROLOŠKIH UVJETA
1	Smanjena vidljivost
2	Olujni vjetar
3	Zimski uvjeti

Figure 5a – Form for reporting data on condition of roads – "Coded Reporting System"

2.3. Critical considerations regarding current condition

Unfortunately, the quality of information does not meet the high criteria of providing updated and timely warnings to motorists regarding potential danger, i.e. the criteria of support and assistance in adverse traffic and weather conditions.

The reasons lie first of all in that the sources or information are not fully updated and they lack quality. In the current organisation, in emergency situations, the on-duty employees at the Ministry of foreign affairs and at the Roads Administration have primarily the task to solve the situation and make the road usable for traffic again, whereas the task regarding public information system is downgraded.



NARODNE NOVINE
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Obavještavanje javnosti o stanju i prohodnosti javnih cesta

List 2

(Nadležna uprava za ceste)

(Naziv rejona stalnog dežurstva)

ZBIRNA OBAVIJEST
o stanju i prohodnosti, izvanrednim događajima te o meteorološkim uvjetima značajnim za odvijanje prometa na _____ *
na dan _____ 199__. godine u _____ sati

Broj ceste*	Ophodarska dionica	Duljina (km)	Stanje i prohodnost*	Izvanredni događaji*	Meteorološki uvjeti značajni za odvijanje prometa*	Napomena
			I.	II.	III.	

* Odluka o razvrstavanju javnih cesta u državne ceste, županijske ceste i lokalne ceste («Narodne novine» br. 79/99 od 27. srpnja 1999. godine)
* Prema šifriranom sustavu dojave

Dostavljeno:
– Sredstva javnog priopćavanja

Predao:

(Ime i prezime)

Figure 5b – Form for reporting data on condition of roads – "Collective Information"

On the other hand, the subjects indirectly involved in informing about the road conditions based on written reports (mass media) do not disclose the data on the exact time the report refers to.

During peak hours, especially in winter, users frequently complain that the users' contact telephone line is busy or that nobody answers the emergency telephone line. This is the result of organisational principles, where, first of all, it is impossible to adapt the tasks both regarding staff and technology to peak hour demands. In winter, when need for information is greater, HAK employs part-time workers who can provide at least basic amount of information on the throughput capacity of the roads.

3. ACTIVITIES TO IMPROVE THE INFORMATION SYSTEM

The above elements that critically consider the current condition impose the need to improve the existing information system in the part of receiving and distributing information.

3.1. Receiving information

The current sources of information regarding condition and throughput capacity of the roads cannot meet the expectations of those who want to use these services. Therefore, new sources of information need to be included, in order to satisfy the expectations of motorists at a higher level. As result, new sources of

information are introduced apart from the previous ones, so as to supplement the existing system as presented in Figure 7:

- introduction of the free public phone (0800-464--464) allowing citizens, carriers and other subjects to report their observations and information on the condition of the roads by stationary (classic) and mobile telephony,
- A shared database on roads and their current condition would be updated every 6 hours, and if necessary (depending on the changes in traffic, density, weather conditions, emergencies, accidents, etc.) even more frequently. The database would be used for data exchange through network by services such as MUP (Ministry of the Interior), HUC (Croatian Road Administration), ŽUC (County Road Administration), IC-HAK (Croatian Touring Club Information Centre). The data would be updated in the centre based on the data collected from the measuring instruments in the field and patrolling vehicles that process the data automatically or semi-automatically and send them promptly, while on the move, to the centre. In this way IC-HAK is directly and in real-time kept informed, and may in turn inform the public within a short period of time about the changes in road condition from every aspect.
- direct on-line connection (modem link) for receiving information from the centres for automatic control of traffic and weather conditions (high-speed roads Delnice – Rijeka and Solin – Klis)

receiving information from the Croatian hydrometeorological institute about actual weather conditions relevant for traffic.

3.2. Distributing information

The current system of distributing information objectively cannot satisfy the needs of users-motorists. By introducing new types of information, the number of direct contacts with the on-duty reporters with the information users is being reduced, as presented in Figure 6.

- information on road conditions and ferryboat traffic, bans for cargo motor vehicles, restrictions due to works are recorded and made available to the users as recorded audio information,
- the mass media (primarily radio stations) receive collective information on the road conditions through electronic mail,
- introduction of web pages on road conditions make the information on road conditions and ferryboat traffic available to all the Internet users.

4. SOME FACTORS IN IMPROVING THE QUALITY OF INFORMATION ON ROAD CONDITIONS

In order to adequately define the long-term development strategy in the information system, it is necessary to consider the existing tendencies in the development of information for the motorists' needs. Today, in practice, there are solutions which make essential changes in the previous approach to motorists' services. Only several examples are illustrated in this work. The ***Intelligent Traffic Guidance System*** – Figure 9, developed in Japan (Tokyo) seems impressive enough. It uses GPS to determine the position of vehicles, and the user is guided to the pre-determined destination based on the digital maps on CD-ROM.

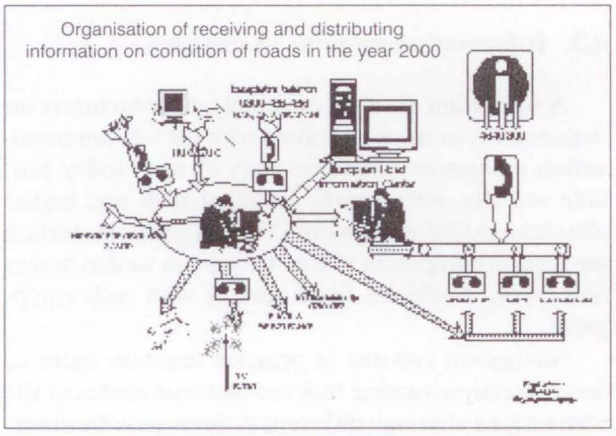

Figure 6 – Organisation of receiving and distributing information on condition of roads in the year 2000

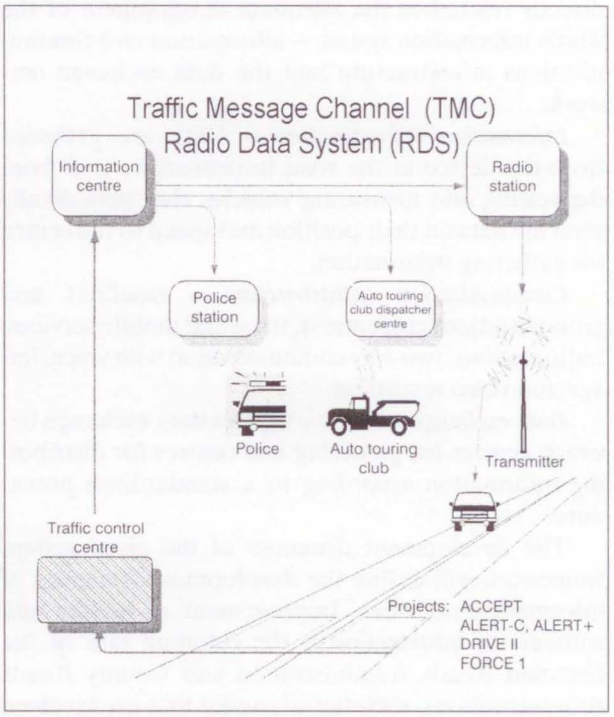

Figure 7 – FORCE 1 – organisation of receiving and distributing information on road conditions

4.1. Studying the problems regarding informing

There are many projects today which deal with the problems of informing the motorists: (CLEOPATRA, EPISODE FORCE1/2, ALERT, ACCEPT, DRIVE, PROMISE) i.e. the problem of controlling traffic (AUSIUS, CAPITALS, CLEOPATRA, COSMOS, DACCORD, ENTERPRICE, EUROSCOPE, FORCE, HANNIBAL, INFOTEN, INRESPONSE, QUARTET, PLUS, SITE, TABASCO, VADE MECUM)

FORCE 1 is a typical example of a project dealing with the information problems, and based on the idea of transmitting information by RDS – Radio Data System i.e. TMC Traffic Message Channel. Force is based on the following principles:

- radio stations are technically equipped and organised so that they can broadcast voice messages on traffic and road conditions on a special channel,
- information on the real-time situations in traffic are collected automatically or semi-automatically
- there are centres for processing the information on roads conditions,
- there are centres for distributing information on road and traffic conditions.

4.2. Structure of the information system on road conditions

The development strategy of informing activities is directly related to the adequate development of the whole information system – information and communications infrastructure and the data exchange network:

Information infrastructure – Data are gathered from the device at the road infrastructure and from the testing and measuring vehicles that periodically send the data on their position and speed to the centre for gathering information.

Communication infrastructure – satellites and ground stations (repeaters), fixed and mobile services, radio stations, two-way communication with voice, image and video recording.

Data exchange network – insures data exchange between centres for gathering and centres for distributing information according to a standardised procedure.

The development dynamics of the given system framework will define the development dynamics of information activities. Improvement of quality and contents of information is the common task of the Croatian Roads Administration and County Roads Administrations, societies of capital that are involved in maintainance and exploitation of roads, Croatian Telecommunications and other telecommunication

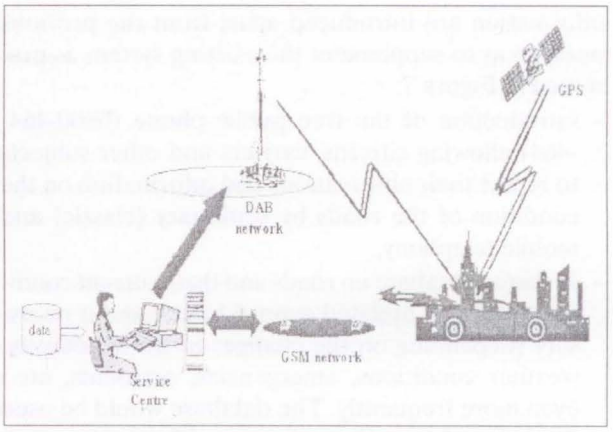

Figure 8 – Communication infrastructure for distribution of information

networks, Croatian Touring Club, Ministry of Interior Affairs, Ministry of Maritime Affairs, Transport and Communications, Croatian radio .....

In any case, the prerequisite for functioning of the whole system in Croatia is the implementation of the GPS (Global positioning system). GPS "relies" on 27 satellites that constantly emit signals to the Earth. The signals are captured by the GPS antenna, and a computer uses the signals and the digitised maps to determine the current position of the device. It is assumed that this method allows positioning within 100 metres of accuracy. For better "positioning" the user's device must receive a signal from the central station that has a range of 100km. If the device is within the range of the central station, the position is calculated and the deviation is less than several metres.

The Republic of Croatia today does not possess adequate navigation, interactive digital maps that would support GPS. Their development and availability on the market depend both on the needs of the Croatian users and on the needs of the "foreigners" during their stay in our country. (The price of such maps on the West-European market amounts to ca. 400 US$).

4.3. Information systems in practice

A significant number of vehicle manufacturers independently or in co-operation with the telecommunication equipment manufacturers already today provide vehicles with serially installed high and higher class navigation equipment. Table 1 presents certain navigation equipment manufacturers as well as makes and types of vehicles fitted serially with such equipment.

Navigation systems in practice function more or less correctly assuming that the motorist abides by the instructions although different systems provide different solutions. Dynamic automatic pilot directs the motorist towards the desired target along the fastest

route. The system acts using the navigation computer, satellite positioning system, gyro sensor, digital road network map (scale 1:10,000 and 1:50,000,000) and vehicle wheels rotation speed sensors. The vehicle position is determined on the map, and the instructions are presented visually and accompanied by voice messages depending on the concrete situation such as e.g. "shift to the right lane", "prepare for a right turn", "turn right". The system for calculating the best itinerary includes also the data on the current situation in traffic.

Table 1 – Navigation systems – manufacturers and makes and types of vehicles fitted with the systems

Manufacturer	Vehicle make	Vehicle type
Blaupunkt	Audi Ford Honda Mercedes VW Lancia	all makes Mondeo, Focus Prelude, Accord A, C, E, S classes Golf, Bora, Passat K model
Philips-Carin	Renault BMW	Laguna, Safrane Series 3, 5 and 7
Nissan	Nissan	Maxima
Siemens	Alfa Romeo Peugeot Porsche	Alfa 166 206, 406 911, boxter
Mitsubishi	Mitsubishi Volvo	Space star, galant, Carisma, Pajero S 70, S 80
Pioneer	Toyota	Lexus, Aisin-warner, Fujitsu-ten
Nippon Denso	Jaguar	S Type

5. CONCLUSION

An average European spends 6 years of his life travelling and spends on this 16% of the total income. The economic development, growing urbanisation, expansion of European economic integrations, increased need for holidays and tourism will result in further increase of the need to travel.

Already today the vehicles are fitted with systems of assistance to motorists: navigation systems, control of vehicle with relation to the vehicle driving in front, avoidance of collisions, automatic control of vehicle position with relation to the road infrastructure, automatic information on weather conditions and roadway state, automatic control of motorist's condition (illness, alcohol abuse, negative effects of medicine and drugs), warning the other traffic participants about the inadequate state of other vehicles and motorists in traffic.

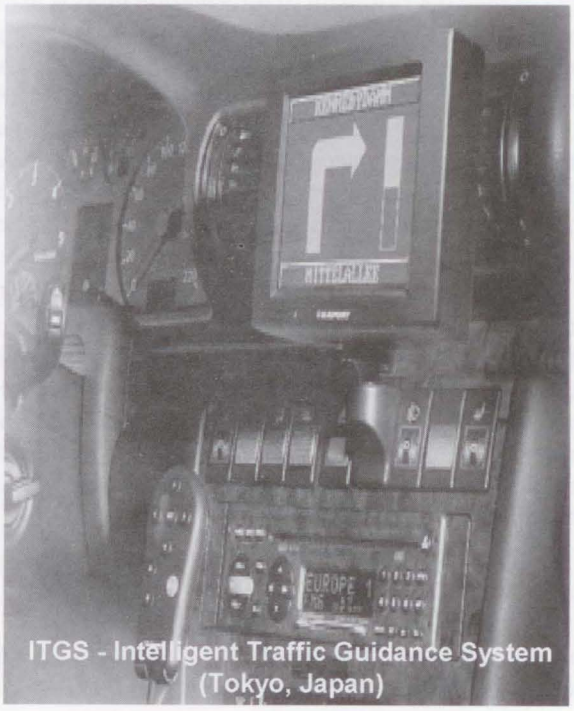

Figure 9 – ITGS (Tokyo, Japan) The future today in Volvo – using GPS the vehicle position is determined and based on digital maps on CD-ROM, guides the user to the destination

The development and implementation of a modern information system regarding Croatian road network conditions is based on using information technology, as well as the presence of several subjects within this system ((HUC, ŽUC, MUP, IC-HAK) and the need for synchronised and co-ordinated activities of all the participants. Therefore, a common single database on roads and their condition provides terminological and logical consistency of data and technological unity of the whole system. Also, it provides the users with real-time information.

It may be concluded that one of the basic phases in implementing a computer assisted system is a shared road database.

On the other hand, Automated Highway Systems (AHS) have been tested many times. Integrated systems for roads control, conflict avoidance, communication along the road and between vehicles, open up the possibility to make some roads, in not too far future, capable of automated guidance of vehicles. Certainly, using such solutions insures a more efficient usage of traffic infrastructure, and as a consequence reduces the need to build new infrastructure.

The technological solutions, applied already today on vehicles and roads will definitely change the existing motorists' information system. Already the development of interactive digital maps – i.e. with integration of Croatia into the global virtual world, the whole system needs to be adapted, meaning that the strategic

approach to development of information tasks is in direct relation to the improvement of data exchange network, i.e. with implementing these solutions in the segment of information and communication infrastructure. Long-term development of information is therefore, only a reflection of the development of the whole traffic system, starting from the development of roads and vehicles and the mutual relations with other traffic branches.

Since the Croatian information system represents only a part of the global information system, it is logical that every solution accepted at the global level will be implemented also in the Croatian information system. In such an atmosphere, the development of the information business is interdependent with economic, sociological, and political conditions and integration of Croatia in general.

SAŽETAK

INFORMIRANJE O STANJU NA CESTAMA U REPUBLICI HRVATSKOJ - PERSPEKTIVE RAZVITKA

Kvaliteta informacija o stanju na cestama u RH ne zadovoljava potrebe njihovih korisnika - vozača cestovnih motornih vozila s obzirom na njihov sadržaj, s obzirom na kriterije ažurnosti i pravovremenosti njihovog objavljivanja i upozoravanja vozača na potencijalne opasnosti, isto tako i s obzirom na kriterije podrške i potpore tijekom nepovoljnih prometnih i vremenskih uvjeta.

U radu se daje kritički osvrt na postojeće stanje u informiranju o stanju na cestama u RH, sagledavaju se razlozi takovom stanju, daju se smjernice za podizanje razine kvalitete ove usluge i perspektive njezinog razvitka.

Navode se aktivnosti koje treba provoditi za poboljšanje cjelokupnog sustava informiranja u smislu nadogradnje postojećeg sustava u segmentima zaprimanja i distribucije informacija, primjene novih tehničko-tehnoloških rješenja (GPS, RDS, TMC) razvoja i unapređenja informacijske i komunikacijske infrastrukture, mreže za razmjenu podataka, uvođenje navigacijskih sustava i sl.

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