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# The Interaction of Safety and Intelligent Transport Systems in Road Transport

# 1. INTRODUCTION

In the process, such as transport, it is necessary to combine several strategic goals to provide transport environment according to its users' needs. The increasing of safety on the roads is inevitably caused process which tries to mitigate the negatives of traffic accidents. The application of intelligent transport systems is very important to hold a sustainable development and the increasing of traffic safety, which is based on collecting, processing, evaluating and distributing the information. The information technologies create the base of transport telematics systems which include information about transport chain and participants of transport. The decreasing of the traffic accident rate can be achieved by informing of drivers and other road users sufficiently. The drivers' voluntary acceptance of information is needed to traffic management, using information systems and because of this fact the credibility of provided information is very important. Traffic variable message signs situated near a pavement are the most suitable solution for the whole traffic flow management. It is possible to provide information about queues, traffic delays, and works on pavement, traffic accidents, and bad weather conditions. It is also possible to provide information to drivers directly to the car. With these systems, it is possible to reduce traffic accident rate and contribute to psychological well- being of the drivers.

*The White Paper on Transport- Roadmap to a single European transport area- towards a competitive and resource-efficient transport system*, gives a significant attention to the road safety issues. European Commission promotes to reduce a number of road transport victims by half compare with 2010 for the years 2011 to 2020 as a priority. This way conceived intent is the key to improving overall performance of the transport system and meet the needs and expectations of citizens and society. The main aim of the Slovak transport policy is to reduce a number of traffic accidents and to increase safety on our roads. The National plan of the Slovak republic for a road safety helps to meet the aim of period 2011-2020. A part of this plan is also the application of intelligent transport systems in the road transport. In figure 1 we can see the decrease in the number of traffic accidents in the Slovak republic.

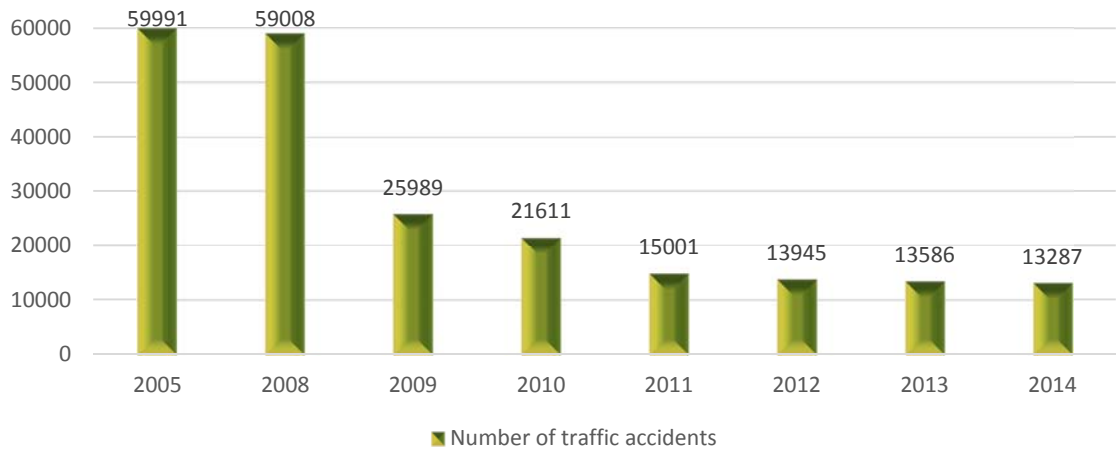


Figure 1: Traffic accidents in Slovak Republic

This decrease is caused by a development and an evolution of automotive technologies, better and more quality roads, better markings and traffic management, as well as organising measures and not at least using ITS.

## 2. ANALYSIS OF DRIVERS' INTELLIGENT TRANSPORT SYSTEMS PERCEPTION IN THE CITY OF ZILINA

In general, we can say that Slovak drivers are not informed sufficiently about the possibilities of obtaining traffic information and using ITS. It is necessary that ITS will become known to general public. Since we wanted to find out how drivers perceive the establishment and the development of intelligent transport systems, we have performed a questionnaire survey.

The minimum sample was determined with help of „ Sample size calculator", where the confidence level was 95% , confidence interval was 5% and population was 98787 of drivers registered in the city of Zilina; the result of those parameters is that 383 samples are needed, see figure 2.

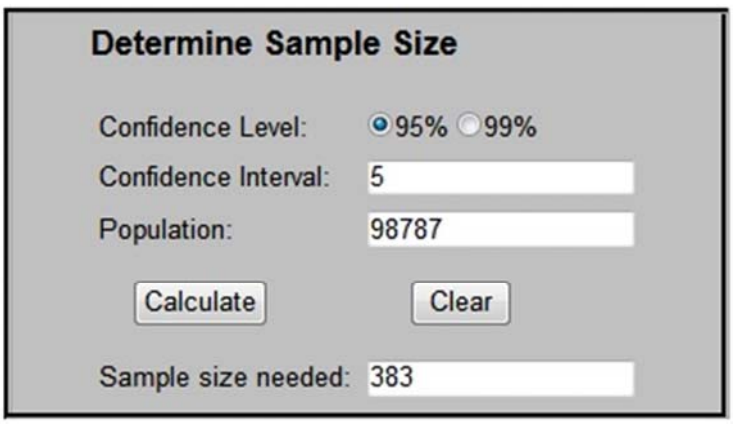


Figure 2 Sample size calculator to calculate minimum sample

In the survey 519 respondents were participated, including 192 women and 327 men. We can say that this survey has sufficiency informative value. Figure 3 shows the proportion of each age category.

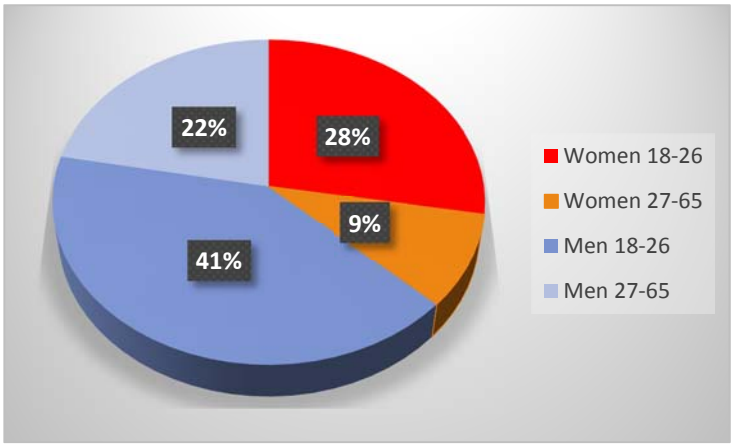


Figure 3: The proportion of each age category

The drivers were divided according to they are passive or active drivers, and also according to their gender. The proportion of the active drivers is bigger than passive drivers. You can see that in the figure 4 and also in the figure 5.

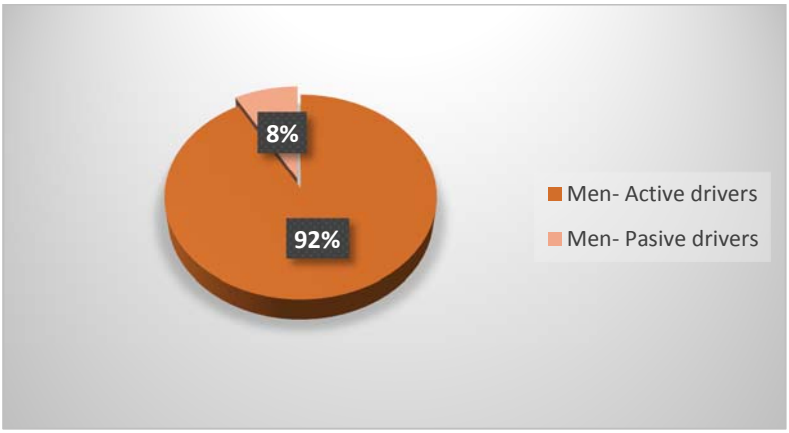


Figure 4: The proportion of the active and passive drivers- men

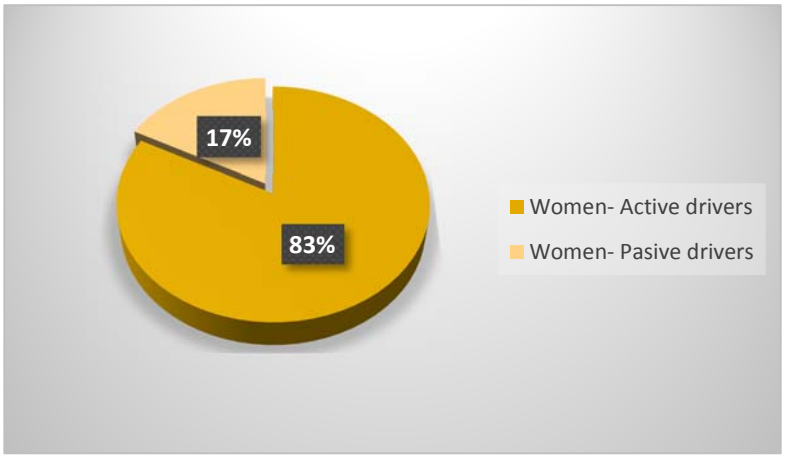


Figure 5: The proportion of the active and passive drivers- women

The next step was to select respondents according to the purpose of their travels. In the figure 6 we can see that drivers travel to the work the most and use their motor vehicles to the school and to visit doctors least.

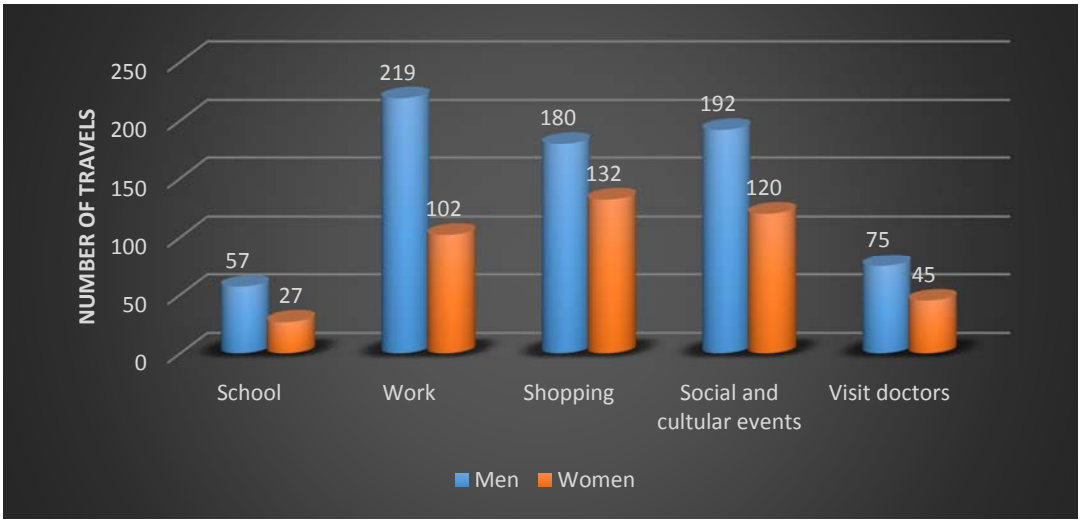


Figure 6: Drivers selection according to a purpose of travels and a gender

Every driver, when choosing his route, prefers route which best suits his needs and criteria. The basic criteria for selecting the most appropriate route are fuel consumption, time availability of destination, distance between origin and destination, risk of traffic accidents, etc. Table 1 shows the weighted arithmetic averages of the importance of individual criteria which are also shown graphically in figure 7. The most important criterion for men in both age categories is quality of road infrastructure. For women the most important criterion is time availability of destination.

Table 1 Weighted arithmetic averages of criteria evaluation for choosing route

| Criteria | Men 18-26 | Men 27-65 | Women 18-26 | Women 27-65 |
|---|---|---|---|---|
| Fuel consumption | 3,59 | 3,52 | 3,10 | 3,75 |
| Destination time accessibility | 3,79 | 3,95 | 3,96 | 4,13 |
| Distance between an origin and a destination | 3,27 | 3,39 | 3,40 | 3,75 |
| Quality of a road infrastructure | 3,80 | 3,97 | 3,90 | 4,13 |
| Risk of a congestion | 3,48 | 3,66 | 3,42 | 3,50 |
| Risk of a traffic accident | 3,23 | 2,71 | 3,52 | 3,69 |

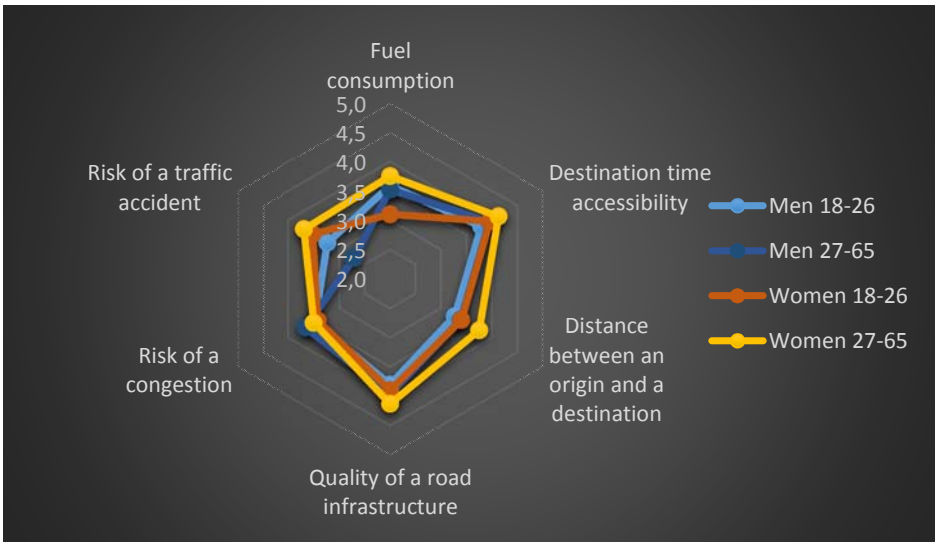


Figure 7: Criteria evaluation for choosing route

The next question that we asked is, if the respondents would accept an alternative way which is offered by information system, when traffic accident or other obstacle on their route occurs. As you can see in the figure 8, the most common response was that respondents would be willing to adopt an alternative route, even if the distance to their destination would be longer more than 2 km and time availability of more than 16 minutes (figure 9 and 10).

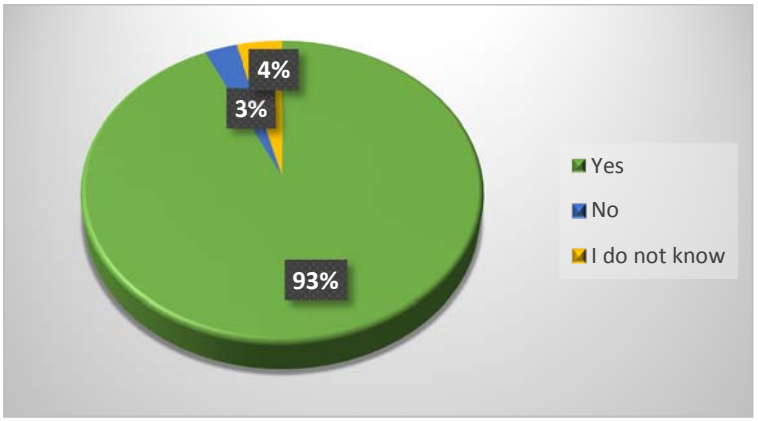


Figure 8: Use of an alternative way offered by information system

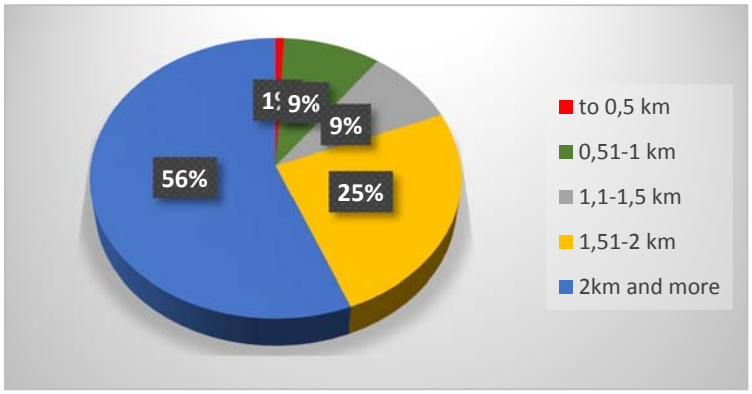


Figure 9: Use of alternative route according to length of detour

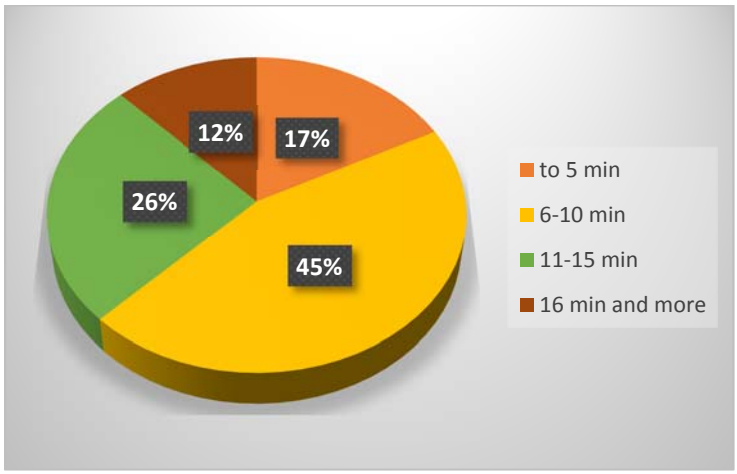


Figure 10: Use of an alternative route according to time availability

When the travel is planned, it is useful to have actual traffic information which the driver can obtain before travel or during the travel, throughout information technologies. The most often use to obtain traffic information according the survey is radio, which is used by 48% of respondents and internet, which is used by 24% of respondents (see figure 11). In the figure 12 is shown the proportion of various systems use by women and in the figure 13 by men.

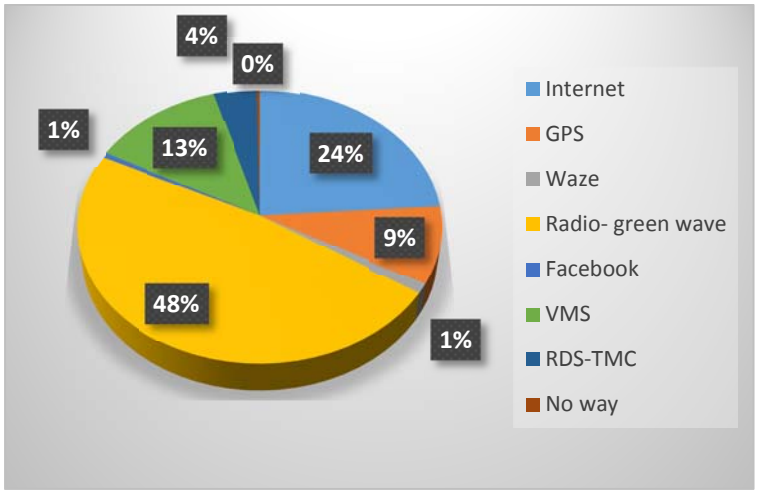


Figure 11: Ways of obtaining traffic information

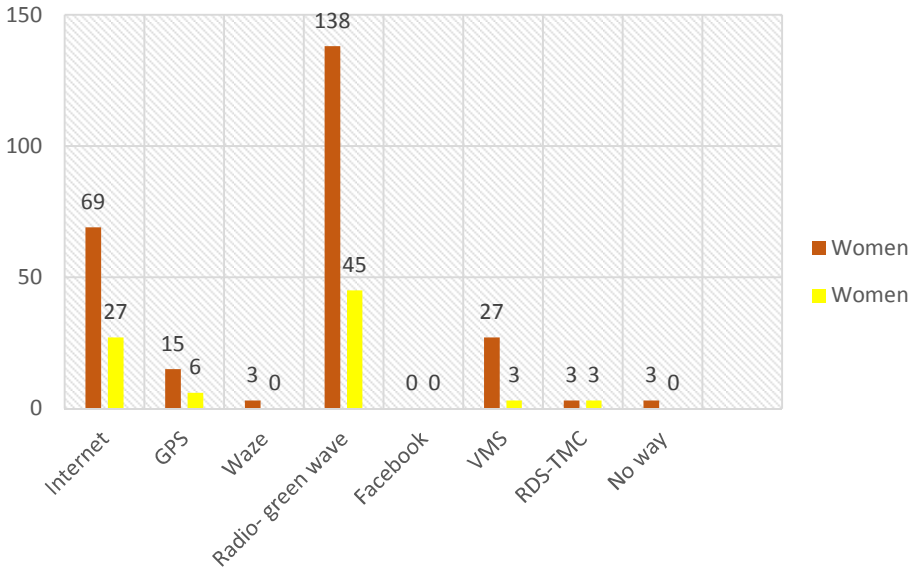


Figure 12: Using IS for obtaining traffic information by women

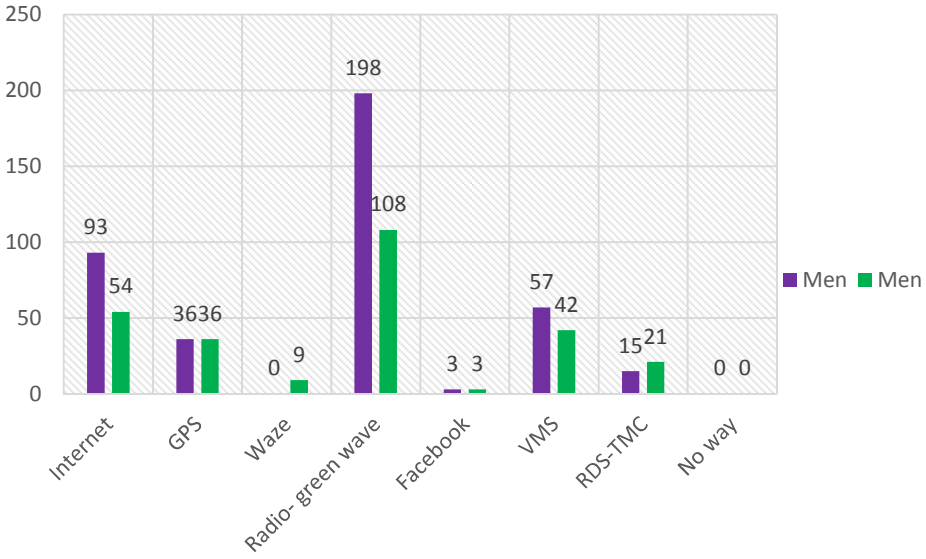


Figure 13: Using IS for obtaining traffic information by men

The next question we asked was whether drivers appreciate intelligent transport systems to alert them to a possible danger and which of dangers they assign as the most important (see figure 14). We analysed the importance of warning to various danger traffic situations from the women's point of view and also from the men's point of view. The survey shows that women consider as the most important to be aware of a black ice and the least of a blind road. Men consider as the most important to be aware of a traffic accident and a black ice and the least of a blind road and a one-way road (see table 2). The survey's results are shown graphically in the figure 15.

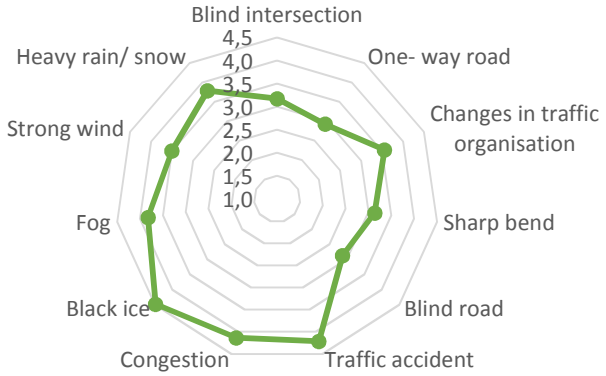


Figure 15: The evaluation of warnings' importance of dangerous traffic situations

Table 2: The evaluation of warnings' importance of traffic situations

| Traffic situations | Men 18-26 | Men 27-65 | Women 18-26 | Women 27-65 |
|---|---|---|---|---|
| Blind intersection | 3,01 | 2,97 | 3,33 | 3,38 |
| One- way road | 2,69 | 2,89 | 3,06 | 3,06 |
| Changes in traffic organisation | 3,56 | 3,87 | 2,62 | 4,19 |
| Sharp bend | 2,99 | 3,08 | 3,35 | 3,13 |
| Blind road | 2,35 | 2,71 | 3,69 | 2,75 |
| Traffic accident | 4,20 | 4,37 | 4,04 | 4,25 |
| Congestion | 3,96 | 4,24 | 3,71 | 4,63 |
| Black ice | 4,18 | 4,53 | 4,29 | 4,94 |
| Fog | 3,17 | 3,61 | 3,83 | 4,69 |
| Strong wind | 2,76 | 3,42 | 3,40 | 4,44 |
| Heavy rain/ snow | 3,15 | 3,68 | 3,83 | 4,50 |

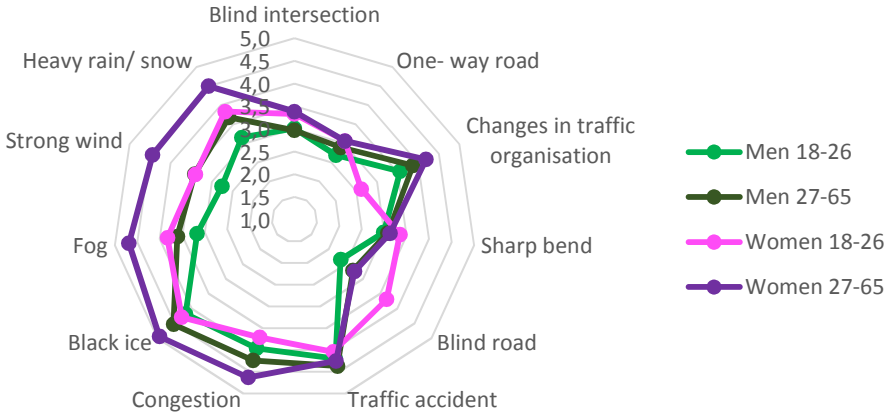


Figure 16: The evaluation of warnings' importance of dangerous traffic situations according to gender and age of respondents

The overall analysis of the questionnaire shows that drivers are opening to the new possibilities of ITS use, especially to increase their own safety during travel.

# 3. DEVELOPMENT AND IMPLEMENTATION OF ITS IN SLOVAK REPUBLIC

Currently in Slovakia, there does not exist sufficient support for the development and implementation of intelligent transport systems. In 2012, we adopted in our binding legislation a directive of European Commission, which defines the basic framework for the ITS implementation and operation. However, there is an effort to improve this situation throughout adopting the National Plan of the Slovak republic for road safety in the period 2011 -2020 and also Program for a support to ITS and NTIS development.

Road safety directing in Slovakia is based on the strategy of Slovak government, as well as European policy. It is not only harmonisation and development of the new intelligent technologies and transport systems, but also to draw up complex strategic measures in field of traffic accidents, emergency services, and definitions of classifying injuries and deaths, as a preparation to adopt the aim to decrease a number of injuries. The National plan's measures must be included among the priorities of subjects who participating in road safety and progressed in their strategic documents.

The Program of development support of intelligent transport systems- National Traffic Information System represents complex solutions of ITS based on the information and communication systems and technologies in Slovak road transport. It is focused on the unified system environment use for collecting, processing, sharing, distributing and using traffic information in the specific information, management and telematics applications. The aim of NTIS is to create systemic linkages which allow to the individual agendas defined in the information systems of these subjects, provide selected traffic information in NTIC's benefit.

The next goal is to integrate maximum of data and information from telematics systems independently on specific owner or operator of ITS. Building of individual telematics systems in transport is very expensive. Therefore, it is necessary and maximum efficiency to provide data from these systems to the widest spectrum of organisations and institutions of public authorities in the form of sharing in NTIS. The specific projects of telematics applications will be realised in the framework of NTIS realising, directly on the existed or prepared sections of motorways, expressways and critical sections of selected road network. Traffic information and traffic data in NTIS will be after verification, addition and authorization in real time automatically or at operator direct released for distribution and publication. The main NTIS operator ensures publication of traffic information and traffic data in the Transport portal of the Slovak republic. The operator in cooperation with Slovak radio will operate RDS-TMC service and via data interfaces he will provide traffic

information and traffic data to the public authorities and also other customers under the contract. In figure 16, there is model design of ITS architecture for Slovakia. In this model there are shown individual relations and communication interfaces between NTIC and customers of traffic information.

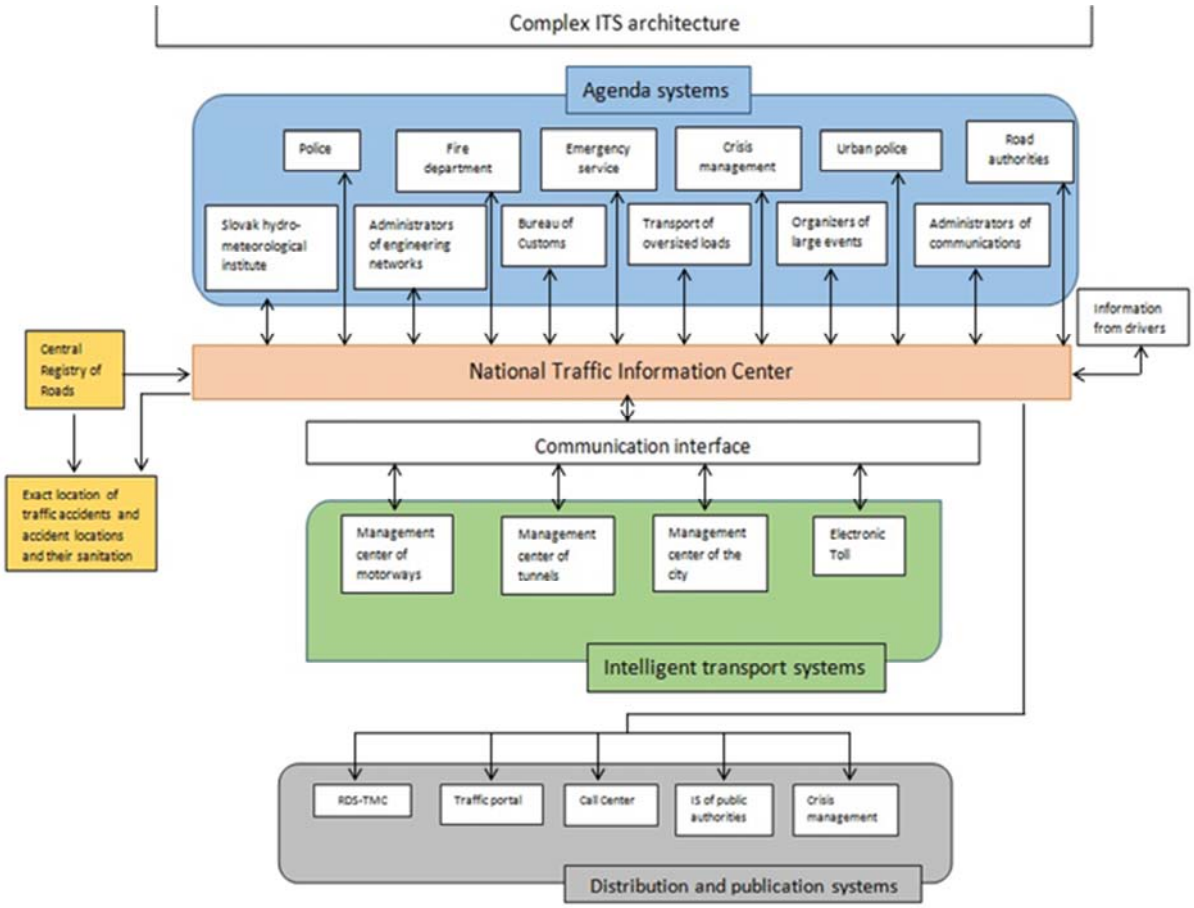


Figure 16: Model design of ITS architecture for Slovakia

## 4. CONCLUSIONS

In present, we have recorded a strong increase in individual vehicle transport on the roads in Slovakia. The result of this situation is that traffic volume in the cities and also outside the cities still increasing which leads to congestions and traffic accidents. The main goal of Slovakia transport policy is to decrease a number of traffic accidents and to increase road safety. The National Plan of The Slovak republic for road safety in period 2011 – 2020 should help to achieve this goal. The Plan also includes the application of intelligent transport systems to the road transport. The Slovak republic is still at the beginning in the field of ITS use, compared with other developed countries.

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**Acknowledgements.** This contribution is the result of the project implementation:
VEGA Project no. 1/0159/13 – KALAŠOVÁ, A. and collective: Basic Research of Telematics Systems, Conditions of Their Development and Necessity of Long-term Strategy. University of Žilina, the Faculty of Operation and Economics of Transport and Communications, 2013-2015.

**Centre of Excellence for Systems and Services of Intelligent Transport II.,**
ITMS 26220120050 supported by the Research & Development Operational Programme funded by the ERDF.