PROCEEDINGS OF THE INTERNATIONAL CONFERENCE

DCI&S 2014

DRIVER-CAR INTERACTION AND SAFETY CONFERENCE 2014

DĚČÍN
10–12 SEPTEMBER 2014

CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF TRANSPORTATION SCIENCES

Improving Road Traffic Safety in the Republic of Kazakhstan (RoK)

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***Abstract* — Analysis of safety level in different countries of the world has shown that human (both casual and intentional) error factor, operator error in particular, is one of the most important and relatively stable factors that influence the number of traffic accidents. It has been established, that a great number of critical errors during driving of a car occur because of failure to timely and properly react to the changing road situation due to limitations of psychophysiological driver condition.**

Key Words — road-transport system, road accident, driver, traffic safety

1. Overview of transport sector of the Republic of Kazakhstan

Automobile transport is an inseparable and a very important component of transport significant role in transport and communication complex of the Republic of Kazakhstan. Among its most important, the following characteristics can be outlined:

A. Popularity and wide availability
B. High maneuverability and speed of passenger transportation and goods delivery
C. Possibility of door-to-door delivery without the necessity of any additional interim operations with goods
D. Providing of near to zero-option short-distance service (delivery within the city and to the suburbs, and those in rural area)
E. High degree of adaptation to different technological processes – both in industry and service sector
F. Relatively low capital capacity.

Given the conditions mentioned above, the automobile transport is considered an inseparable component of all modern transport technologies including the integrated and multimodal transportation [1].

1.1. Cargo transportation

The transportation delivery activity in the Republic of Kazakhstan trends to be increasing in terms of capacity of delivered goods. According to RoK statistics Agency, 3 627,9 million tons of goods have been transported of transport networks of the Republic of Kazakhstan within the period from January to December in 2014, which is 3.7% more than within the same period in 2013. The cargo turnover for the given period was evaluated as equal to 487.4 billion t/km, 21293,00 billion pf passengers have been transported (which is 6.5% more than during January-December 2013), passenger turnover was 249,6 billion t/km (increase per 6.8% compared to 2013).
According to the Agency data, the proportion of automobile transport in relation to both transportation volumes and goods turnover has been increasing each year. Currently automobile segment occupies 86,23% from total amount of delivered goods, 7,54% belong to railway transport and 6.09% — to pipelines, and 0.14% — to the other means of transport (air, internal water transport) – see Figure1.

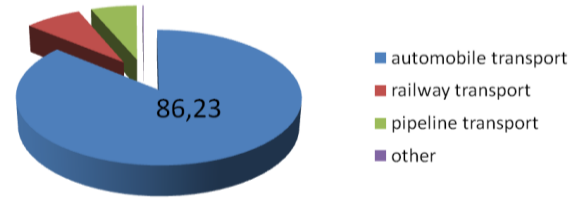

Figure 1: Distribution of total transportation volumes among the means of transportation

As shown by world and homeland experience, automobile transport is ultimately adapted to be functioning in the conditions of market demand and supply. It can be proved by the fact that transport and communication complex was the primary choice for realization of privatization [2].

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Personal cars in the Republic of Kazakhstan on 01.12.2014									
Region	Total	Engine volumes							
		under 1100 cm^3	from 1100 to 1500 cm	from 1501 to 2000 cm^3	from 2001 to 2500 cm^3	from 2501 to 3000 cm^3	from 3000 to 4000 cm^3	above 4000 cm^3*	Others**
The Republic of Kazakhstan	**3 906 196**	**41 963**	**603 799**	**1 613 893**	**599 136**	**404 286**	**110 369**	**67 494**	**465 256**
Akmolinskaya	179 627	1 233	37 796	77 326	21 571	12 715	2 288	1 439	25 259
Aktyubinskaya	161 021	1 435	20 674	76 660	17 334	15 668	2 960	1 861	24 429
Almatinskaya	489 787	6 820	85 510	209 835	99 029	56 222	11 476	6 802	14 093
Atyrauskaya	114 626	839	14 290	54 368	12 512	13 494	2 285	1 393	15 445
Zapadno-Kazakhstanskaya	115 412	919	12 337	55 336	10 448	8 765	1 434	702	25 471
Zhambylskaya	189 594	1 541	31 172	76 193	30 912	16 299	3 148	1 607	28 722
Karaganinskaya	346 424	2 894	41 962	144 430	51 208	36 727	9 297	5 376	54 530
Kostanayskaya	213 117	1 561	40 884	93 334	24 719	13 366	3 501	2 035	33 717
Kyzylordinskaya	108 928	485	15 630	45 642	18 307	12 455	1 925	1 616	12 868
Mangistauskaya	141 570	1 237	15 428	66 361	21 648	20 476	4 840	3 570	8 010
Juzhno-Kazakhstanskaya	466 058	7 000	101 550	199 650	70 086	32 488	6 781	4 688	43 815
Pavlodarskaya	167 413	1 510	26 069	65 418	23 074	11 471	3 312	1 678	34 881
Severo-Kazakhstanskaya	164 978	1 183	28 638	64 178	16 359	10 454	1 879	1 019	41 268
Vostochno-Kazakhstanskaya	309 234	2 969	62 026	117 519	40 974	24 013	6 132	3 154	52 447
The city of Astana	241 575	2 576	23 753	111 701	44 062	31 449	13 089	8 643	6 302
The city of Almaty	496 832	7 761	46 080	155 942	96 893	88 224	36 022	21 911	43 999

Table 1: Number of vehicles in the Republic of Kazakhstan

"Others" – meaning the engine volume is not specified

* under 10000 cm^3
** other vehicles

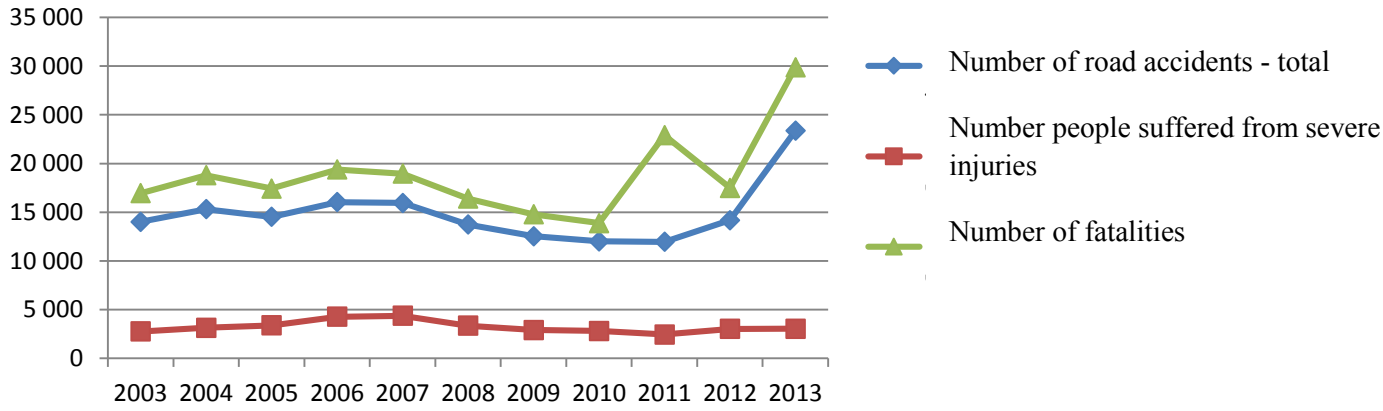

Figure 2: Dynamics in changing of number of traffic accidents and victims

1.2. Automobilization in RoK

The national automobilization rate is determined by the degree of saturation of vehicles determined by the number of personal cars per 1000 of population. In our country, the rate is equal to 197 veh/1000 ppl [3].

To compare with the other countries that have high automobilization levels, the rate if following for: the USA – 423 veh/1000 ppl, Italy – 602 veh/1000 ppl, Japan – 453

veh/1000 ppl, Czech Republic – 427 veh/1000 ppl, the Great Britain – 457 veh/1000 ppl, Spain - 481 veh/1000 ppl, France - 481 veh/1000 ppl, Germany - 517 veh/1000 ppl, Russia - 233 veh/1000 ppl (data available by the end of 2010) [4].

The rate of 197 vehicles per 1000 of people is given related to the Republic in general, it varies in different cities and regions. Thus, in Almaty – it is 360 veh/1000 ppl, and in Astana it equals to 235 veh/1000 ppl.

Along with non-arguable positive sides of automobilization the phenomena is accompanied by the increase of social and material damage as theconsequences of traffic accidents. Any vehicle is a potential source of high risk for people, and this risk has increased for the last years, as the result of increase of power of engines and traffic velocities.

2. Traffic accident rates and analysis

It is worth of mentioning that despite the lower levels of automobilization in the country, the severity of traffic accidents consequences in our country is 7 to 10 times higher than that of the USA and of most of the countries in Europe [3].

During the period from 2009 to 2013 there have been registered 19363,0 traffic accidents on the roads of the Republic of Kazakhstan, there has been 18650,0 number of fatalities and 27085,0 have suffered from severe injuries, including the traffic accidents on highways – 12375,0 traffic accidents, 5960,0 fatalities and 17798,0 people have suffered from severe injuries. [5].

2.1. Reasons of traffic accidents

Analysis of detailed data provided by ministry of road police of the ministry of Interior of the Republic of Kazakhstan contains information about the number, types and reasons of traffic accidents has revealed the following basic reasons:

- Every fifth traffic accident (21,1% from the total number of accidents) occurs due to not following the speed limitation instructions.
- Every twelfth accident occurs due to not following the regulatory traffic rules and signs (8,4% from the total number of accidents).
- The reason of every tenth traffic accident happens because of departure towards the lane with the opposing traffic. (9,4% from the total number of traffic accidents).
- Not following the intersection crossing rules is the reason of 9,5% of traffic accidents.
- And 7,1% of accidents are happening because of not following the traffic rules of pedestrian crossing by drivers.
- 1,6% of traffic accidents happened because of influence of alcohol.

2.2. Human factor in traffic accidents

From this, it can be concluded that number of accidents has been constantly increasing, while 85% of traffic accidents happen because of driver behavior.

A driver of a vehicle is an element in the chain “driver-car-road-medium”, and stable functioning of this system defines the efficiency and safety of road traffic.

While driving a car, a driver is constantly in a state of a certain degree of tension. While driving he/she is constantly percepting and processing the information about the surrounding dynamically changing traffic and road situation, position, speed and state of ones vehicle and he/she is taking the instantaneous decisions of action. Such a vivid and constant flowing of psychical phenomenon in the conditions of a situation when everything is changing so quickly and thus is increasing the tension of driver’s nervous system and by this is leading to driver fatigue and, sometimes, to excessive fatigue [6].

When driving a human needs to percept and analyze a huge amount of information (the road, traffic regulation, traffic signs and road marking, information displayed on the vehicle control panel, operation of systems and mechanisms of car, weather conditions etc.). Besides, he/she needs to make prognosis of road situation development and select the optimal traffic regime for maintaining the desired safety level.

When driver is feeling not well or is sick, it can effect badly his/her performance and correspondingly, increase the risk level of occurring of traffic accident. The negative psychology can be one of the predefining factors for accident [7].

The basic psychophysiological sources of the accidents are:

A. Limited psychophysiological driver capability
B. Low level of driver experience
C. Lack of responsibility
D. Labor conditions that draw to over fatigue
E. Inadequate traffic information means, which draws to decrease of level of percepted information.

Along with so many advantages of automobilization there is a tendency of increase in social and material losses as the consequences of traffic accidents. There is a necessity to secure the driver factor, meaning the increase of reliability of it as an agent in the system.

To respond to the safety and reliability needs a driver has to be maximally lucid [8].

Conclusions

Currently Kazakhstan faces the increase of exploitation of number of vehicles and constant increase of traffic intensity. Along with the advantages of the automobilization there is a tendency of increase in social and material loses as the result of traffic accidents. It has been concluded that it is important to decrease the influence of human factor at the accident rates by increase of driver agent reliability.

To solve the problem it is necessary to perform the related research work and explore the psychophysiological condition of driver while being influenced by various factors. Thus, it is important to do the following:

1. Create the database of traffic accidents where appears a psychophysiological driver condition factor
2. Explore the factors that influence driver and his/her state during performing the main task.
3. To develop and propose the methodologies for research of psychophysiological driver condition and its influence on the road traffic.

References

[1] Bouchner P., Novotný S., *System with driving simulation device for HMI measurements*, 8th WSEAS International Conference on SYSTEMS (part of the 8th CSCC Multiconference), Athens,2005

[2] Bouchner P., Novotný S., Piekník R., *Measurements and analysis of data measured from real car driving used for development of research driving simulators*, CTU Workshop, Prague, 2007

[3] Bouchner, P., *Driver's Micro-sleeps Detection Using Virtual Simulation*, In: SSGRR - 2004, NNW 14. Piacenta: ICS UNIDO, 2004, vol. 1, pg. 3-15.

[4] Bouchner, P., *VR Simulation Device as a Support for Research in Driver's Micro-sleeps and Attention Decrease Detection* , TRANSTEC 2004, Athens, Greece, 2004, vol. 1, pg. 65-72.

[5] Edwards M., *Improving safety with on-board monitoring and control systems using CAN technology*, CIA, iCC 10th international CAN Conference 2005

[6] Nordmark S., Palmkvist G., Sehammar H., *Recent and future improvements the VTI DRIVING SIMULATOR with special emphasis on the steering system and moving base*, Driving Simulation Conference, Sophia Antipolis, 2001