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Transportation Research Procedia 20 (2017) 242 – 246

Transportation Research Procedia

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12th International Conference "Organization and Traffic Safety Management in large cities", SPbOTSIC-2016, 28-30 September 2016, St. Petersburg, Russia

Potential for Enhancing Traffic Safety on Highways of Russia

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Abstract

The article investigates the correlation between the factors of enhancing traffic safety on highways and parameters of the economic growth in Russia and in countries with transition economy; such correlation does not always lead to traffic safety enhancement. As a rule, the population motorization (car density) level growth in such countries is not accompanied by efficient actions on accident rate decrease. Among the factors enhancing traffic safety on highways are the efficiency of traffic infrastructure planning (changing and removing traffic flows from cities' centers, creation of a large amount of pedestrian and bicycle lanes separated from traffic flows) as well as harmonization of physical infrastructure and safety goals, ensuring conjugation of the developed transport infrastructure with the decrease of the share of private vehicle fleet and increase of the share of public transport.

Peer-review under responsibility of the organizing committee of the 12th International Conference "Organization and Traffic Safety Management in large cities"

Keywords: car density; traffic infrastructure; safety goals

1. Introduction

Road traffic accident (RTA) fatality remains one of the most pressing problems in the modern world. For example, according to the data of the Association for Safe International Road Travel, yearly worldwide in RTAs about 1.3 mln persons die and from 20 to 50 mln persons are injured and lose work capacity on the average; the consequent economic loss is evaluated approximately at USD 518 bln. Losses of developing countries are evaluated

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Peer-review under responsibility of the organizing committee of the 12th International Conference "Organization and Traffic Safety Management in large cities"
doi:10.1016/j.trpro.2017.01.058

at USD 65 bln, which significantly exceeds the economic aid received [Association for Safe International Road Travel (2016)]. One of the key reasons of traffic hazard growth is the growth of the motorization level (a number of vehicles per 1000 residents), especially in countries with the average GNI per capita.

2. Main text

2.1. On the correlation between the traffic safety level in Russia and the national income growth

Middle-income countries are those having GNI ranged from 1 to 12 thous. USD annually per person [Worldbank (2016)]. According to the data of the World Health Organization (WHO), such countries account for 53% of the world car fleet and 74% of death toll in RTAs [WHO (2015)]. Though Russia falls under the countries with high income (about USD 23 thous. yearly per person considering the purchasing power index (PPI)), its traffic safety lags far behind the level provided today in many European countries. For comparison, in European countries, car density per 1000 residents fluctuates from 480 to 600, and the fatality rate (per 100 thous. residents) fluctuates from 2.9 (the Great Britain) to 6.1 (Italy) [WHO (2015)]. In Russia, this coefficient is 18.9 which is the level of such countries as China (18.8), Morocco (18.0) and Ecuador (20.1), though these countries fall under the middle-income ones. As for car density per 1000 residents, in Russia this index is 302 almost as in China (297), but twice as less than this index is in European countries [European Union (2011)].

Fig. 1. shows regression between the number of RTA fatalities (per 100 thous. of the population) and GDP per capita (current USD rate) for G20 countries.

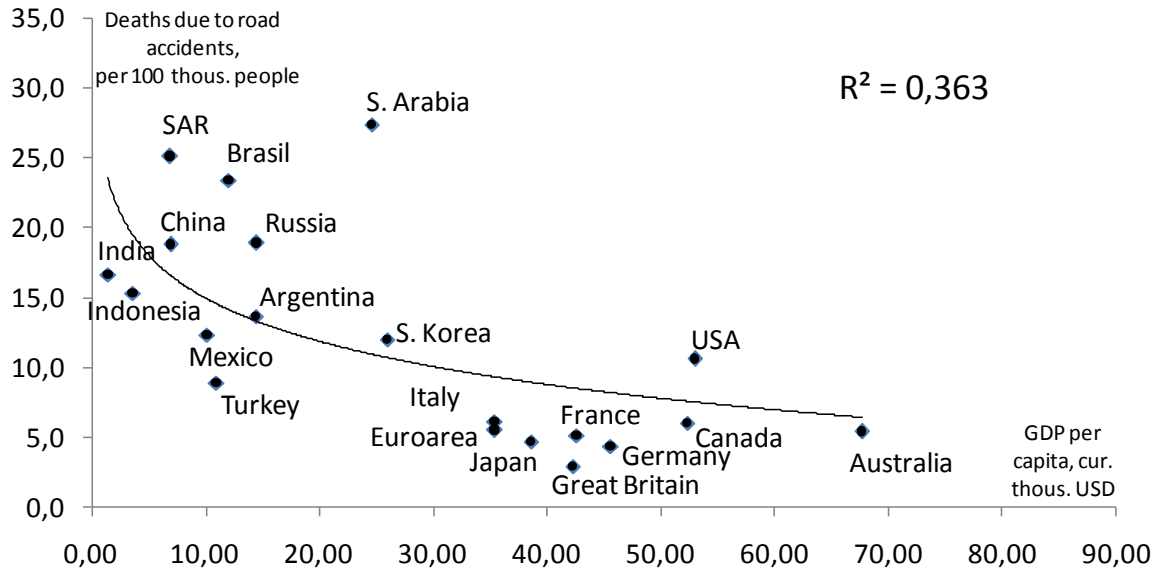

Fig. 1. Regression between the number of RTA fatalities depending on the living standard in G20 countries (as of 2013).

Fig. 1 shows that such countries as Turkey, Mexico, and Argentina (leaving alone more developed countries in the euro region), at the living standard comparable to the Russian one, have significantly lower RTA fatality rates — 8.3, 12.9 and 13.6 persons a year per 100 thous. people, respectively. It means that the potential for efficient traffic safety organization in the Russian Federation is not fully used and there are hidden resources which could help decreasing the RTA fatality rate in Russia. The study undertaken as long ago as in 1985 based on the RTA data in the USA and Great Britain [Rumar (1985)] showed that 57% of RTAs were exclusively due to driving mistakes, 27% of RTAs were due to the combination of driving mistakes and unsatisfactory road conditions (URC), 4% of RTAs were due to the combination of URC and vehicles' breakdown, 3% of RTAs were due to URC only. Thus, up

to 34% of RTAs are associated with the structure and state of roads in any way. Domestic statistics as of 2015 proves this data: according to the data from the State Traffic Safety Inspectorate, the number of RTAs under unsatisfactory conditions and arrangement of the street and road network amounted to more than 63 thous. or 34.3% of RTAs in total. In our opinion, they are mainly associated with the improvement of traffic infrastructure.

2.2. Analysis of statistics with regard to RTAs on highways in Russia

In 2015, totally in Russia, 184, 000 RTAs were reported with 23,114 fatalities and 231,197 persons injured [STSI (el. resource)]. The share of RTAs occurred through the fault of vehicles' drivers was very high — 85.8%, (for comparison, this index in the USA and Great Britain is 57%), and 13.5% of RTAs occurred through the pedestrians' fault. The share of RTAs occurred due to drunk driving amounted to 7.8% of total RTAs; at that, the share of fatalities in these RTAs was twice as much — 15.8% of the total number of fatalities. 59.3% of RTAs occurred due to vehicles' crashes including collision, rollover, running over a fixed obstacle (including a stationary vehicle), and 30.9% of RTAs were classified as running over a pedestrian. Compared to the developed countries, the latter index is very high; for comparison, in the majority of the European Union countries, the share of pedestrians died in RTAs is less than 15% of the total number of fatalities while in Russia it slightly exceeds 30% [WHO (2015)].

In 2015, the number of RTAs in large Russian cities[†] (with the population exceeding 1 mln) amounted to 39, 504: 2,001 fatalities, 46,717 persons injured. Considering that the total population in these large cities is 32, 972 mln persons, the RTA fatality rate in large cities in percent amounts to 6.07 persons yearly per 100 thous. of population, which is much lower than the average value in Russia. For comparison, outside million-plus cities, the RTA fatality rate is 22.6 persons yearly for 100 thous. of population. It is partially associated with the fact that though 69.9% of RTAs occur in cities and populated localities, but the fatality rate for one hundred RTAs in cities is significantly lower — 6.8 persons instead of 25.9, i.e., beyond cities and populated localities, the RTA fatality rate is four times higher. Thus, the main possibility of decreasing the RTA fatality rate in the country is generally associated with enhancing the traffic safety beyond cities and populated localities which, according to statistics, account for 62% of the total number of RTA fatalities.

However, compared to the large cities of the developed countries, the RTA fatality rate in Russian million-plus cities remains as high as before. Thus, in Berlin, the fatality rate for 100 thous. of population is 1.2 persons a year, in London — 1.5 persons a year, in Ottawa — 3.2 persons a year, in Toronto — 3.5 persons a year, in New York — 4.5 persons a year (all data are for 100 thous. people). For comparison, in Moscow, this coefficient is 5.5, in Saint Petersburg — 6.8; the highest indicators are in Perm and Voronezh — 8.6 and 10 persons a year for 100 thous. people, respectively (see Table 1).

Table 1. RTA statistics in large Russian cities as of 2015.

	Registered RTAs	RTA fatalities	Injured in RTAs	RTA fatalities for 100 thous. persons	Number of light motor vehicles per 1000 persons*
Russia	184,000	23,114	231,197	15.78	302
Moscow	103,96	673	11,903	5.46	316
Saint Petersburg	7,243	354	8,512	6.77	313
Novosibirsk	1,762	79	2,012	4.99	327
Ekaterinburg	972	79	1,227	5.53	368
Nizhny Novgorod	2,056	71	2,490	5.60	324
Kazan	1,957	65	2,246	5.34	277
Chelyabinsk	1,959	87	2,386	7.30	309
Omsk	2,588	93	3,155	7.89	284
Samara	1,119	77	1,375	6.58	306
Rostov-on-Don	1,726	73	2,141	6.55	307
Ufa	1,912	65	2,405	5.88	312

[†] Moscow, Saint Petersburg, Novosibirsk, Ekaterinburg, Nizhny Novgorod, Kazan, Chelyabinsk, Omsk, Samara, Rostov-on-Don, Ufa, Krasnoyarsk, Perm, Voronezh, Volgograd.

Krasnoyarsk	1,897	77	2,185	7.22	316
Perm	1,995	90	2,429	8.64	294
Voronezh	1,136	103	1,325	9.98	339
Volgograd	742	64	854	6.29	353

* for cities, the assessment considers the respective subject of the Russian Federation
Source: gibdd.ru

For the purpose of more detailed comparison, we contrasted two largest Russian megalopolises and analog cities; Moscow was compared with New York, Saint Petersburg was compared with Singapore. The results are given in Table 2. It is obvious that the RTA fatality rate in both Russian cities is higher than in the analog cities. If Moscow, compared to New York, differs not so much (5.5 persons per 100 thous. people versus 4.5), in Saint Petersburg ,compared to Singapore, the RTA fatality rate is almost two times higher. Moscow partially benefits from the fact that its population more intensively uses public transport (underground and aboveground transportation exceeds New York indices 2–3 times). The low road density comes under notice as well (per a square meter of urban area): in Russia, it is twice as smaller than in the selected analog cities. At that, the number of cars per 1000 persons is higher in Russia (more than 300 versus 213 in New York and 101 in Singapore). To decrease the RTA fatality rate in Russia, we need new roads, routes, thoroughfares that will decrease the traffic density in cities and reduce the load on intersections. And finally, the high rate of pedestrians' fatality comes under notice: in Moscow and Saint Petersburg, it is above 50%, while in the analog cities it is under 30%.

Table 2. RTA statistics in Russian megalopolises compared to analog cities.

		New York	Moscow	Singapore	Saint Petersburg
1.	Population (thous. persons)	8,337	12, 30	5, 12	5, 25
2.	Highway stretch (km)	10,105	6, 302	3, 426	3,206
3.	Square area (km^2)	790	1081‡	716	1,439
4.	RTA number (units)	48,302	10396	n/a	7,243
5.	RTA fatalities (persons)	239	673	197	354
6.	RTA fatalities (persons per 100 thous. of population)	4.5	5.5	3.6	6.8
7.	Number of cars (units per 1000 of population)	213	316	101	313
8.	Road density (km per square km)	12.79	5.83	4.79	2.23
9.	Population density (persons per square km)	10,553	11, 06	7,422	3,631
10.	Stretch of underground lines (km)	373	333.5	178	113,5
11.	Daytime underground transportations (thous. persons per day)	4,521	7,013	2,649	3,002
12.	Daytime bus transportations (thous. persons per day)	1,825	4,922	3,481	1,394§
13.	Accidents through the driver's fault	78.5%	83.4	n/a	79.6
14.	Including drunk driving	2.9%	3.3%	n/a	2.0%
15.	Fatalities due to drunk driving	10.6%	6.8%	1.2%	3.1%
16.	Pedestrians' fatalities in the total number of RTA fatalities	26.1%	50.8%	27%	54.5%

2.3. World practice in the field of ensuring traffic safety in large cities as a factor facilitating its enhancement in Russia.

It is necessary to mention the key factors distinguished by western experts proceeding from the analysis of the situation as to ensuring traffic safety on highways and in big cities. One of the famous international experts in the field of the traffic infrastructure planning and control, professor Brindle (2001) notes with a great disappointment that modern approaches to the traffic safety planning in industrially developed countries do not consider such

‡ As of 2010 (before Moscow territory expansion by way of administrative annexation of the Moscow region lands).
§ Excluding small businesses.

principally important factors as harmonization of physical infrastructure and safety goals. He also notes absence of conjugation in a developed transport infrastructure between decrease of the share of private vehicle fleet and increase of the share of public transport; moreover, the planning process itself dominates over safety ensuring goals. Other experts [McAndrews (2010)] note the importance of such factors as the quality of infrastructure, driving conditions and culture, legal enforcement forms against violations of road traffic regulations which, by the way, differ in various countries. In opinion of the author of that very research, the experience of Sweden is worth noticing, the country which as long ago as in the middle of the 20th century enunciated the principle of multimodality of transport systems with due consideration of the interests of all road users — main and transit transport, pedestrians, bicyclists and motor-cyclists; and engagement of architects, town planning specialists, and transport engineers in the implementation of this principle allowed for the creation of the safest transport system in the world. According to the materials of the Asian Development Bank Transport Forum (2014), the urban population will double up to 2050 worldwide, at that Asian urban population will grow by 1.1 bln persons in the nearest 20 years. Tripling of the vehicle fleet from the current 1 bln is expected up to 2050. The expected car density in China, which is the most populated country in the world, by 2035 will reach the value of 315 units. It is also necessary to consider the significant growth of the number of bicyclists on urban roads: China accounts for 500 mln bicycles, and in such countries as Holland, Denmark, and Germany the number of bicycles almost equals to the population size [Top10Hell (2016)]. As far as the fatality rate on urban roads in China, India, and Indonesia is matchlessly higher (almost 20 times higher) compared to such cities as Stockholm, Tokyo, or Hong Kong, the further disregard of the issues associated with efficient planning of traffic infrastructure (changing and removing traffic flows from cities' centers, creation of a large amount of pedestrian and bicycle lanes separated from traffic flows) becomes impossible. The integral part of the safety enhancement policy is to be formed by new standards for safety requirements to vehicles, procedures for obtaining driving licenses and stiffening of legal standards for traffic violations.

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