

Using mobile devices while driving in Croatia – preliminary analysis

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Abstract—Research has shown that using a mobile device while driving increases the risk of traffic accidents by up to five times. From 2010 to 2014, Croatia has doubled the number of offenses caused using mobile device while driving. Current methods of prevention have succeeded in reducing the number of offenses (reduction of 6% in 2016), which justifies the investment in ways to improve prevention. Except the financial penalties, activities in the form of prevention and awareness raising about the negative impact of the use of mobile devices on driver behavior and the safety of road traffic in Croatia are insufficiently pronounced. The aim of this research is to determine the intensity of the use of mobile devices and to find to what extent would certain technical, technological and regulatory measures trigger a reduction in use.

Keywords- mobile phones, drivers, safety, distraction

I. INTRODUCTION

Depending on the life situations and the type of job, people are accustomed to frequent use of mobile phone. The use of mobile device while driving allows the driver to immediately access the information that is essential to him. However, this ability comes with few negative effects for the driver as its one of the ways of driver distraction. According to currently available literature, there are several types of distraction (talking to in-car companion, radio device, navigational device, etc.), but the use of mobile device while driving has the most dangerous effect. This is because actions such as telephony, writing messages, or reviewing websites require visual, sound and cognitive attention of drivers, and hence the safety of road traffic gets disrupted.

Details from police reports of traffic accidents are included in 'Bulletin about road safety' published by the Ministry of the Interior of the Republic of Croatia – MUP. This Bulletin is the only official national statistical database about the number of traffic accidents and the most frequent causes of accidents, publicly available for the education of traffic participants about the risk factors in traffic. Although the previously mentioned available basis contains the most frequent causes of accidents, including the category of the roads, there are some accident causes that are not easily identified. This is primarily the case of the use of all types of mobile devices while driving (mobile phones, smart watches, embedded information and entertainment systems, etc.).

The most pronounced risk factors related to the problem of mobile phone influence on driving are insufficient awareness

and the fact that the use of mobile phone while driving is an increasing trend that is considered as common. This research is presented and financed by the project of The National Road Safety Programme of the Republic of Croatia 2011 – 2020, under the title 'The impact of mobile device usage on drivers' behavior'. The following chapters present developed research methodology and the preliminary research results gathered through questionnaires form Q1 and Q2 stages of the project. The aim of the project is the introduction of preventive actions for raising the collective awareness, informing and drivers education about the negative effects of the use of mobile devices while driving. During the project, the objective is to study driver's behavior in real-life situations and in car-test polygon environment. The research results will provide the ground for forming the national informative Web 2.0 portal as the media intended for educating on the dangerous effects of using mobile device while driving.

II. PREVIOUS RESEARCH

Drivers who use a mobile device while driving are distracted for 5 seconds in average, i.e. do not follow the road in front of them, and by driving at a speed of 50 km/h exceed 60 meters of road completely unaware of the traffic. Due to this reason, 3,328 drivers were killed in the United States – US in the year of 2012, while the 48% of US drivers stated that they regularly use their mobile devices while driving [1]. That is why it is extremely important to warn all traffic system participants on the sources of threats and to form informative and educational actions for reducing the threat and strengthen the safety.

Research results from Canada have shown 52% of respondents continue to use mobile phone while driving, regardless the awareness of the driver about the possible road safety threats. About one fifth (1/5) respondents answer their phone immediately no matter of the present situation in traffic [2]. Respondents who use their phone while driving and the ones who don't, both, agreed that the using of mobile phone for writing and reading messages while driving is very dangerous, and that the use of mobile phone while driving is as dangerous as driving drunk [3].

In 2013 distracted driving was the cause of 2,910 deaths in car accidents in the US, from which 14% was caused because the use of mobile phone while driving, i.e. 455 lives were lost due to the mobile phone usage behind the wheel. Recordings

from police reports say that drivers were having phone conversations or used their mobile device for listening to music or some other possibility when the accident occurred. According to the data of this research, drivers no younger than 20 and no older than 29 use mobile phone while driving in 38% of cases [4].

One of the chapters within the research contains drivers as the subject of research. Through the research of mentioned safety phenomenon, the authors strive to find out if negative potentially socially dangerous driver behavior is the characteristic of the mass. The conclusion of the research brings out the fact that more than half of drivers are being distracted while driving because of the use of mobile phone [5]. The authors state that young and inexperienced drivers, belonging to the 'web population', make the most endangered group. These drivers intensively use sophisticated applications, read and write messages, take photographs and make videos while driving and therefore are labeled as the 'mobile killers'.

Because of these distractions, drivers monitor the ongoing traffic situation four times less while driving [6]. Similar results are given within simulated traffic environment where young drivers were using social network applications on their mobile device while driving [7].

The research on psychological factors of mobile phone addiction results with conclusions of positive correlation on mobile phone usage while driving. According to stated, drivers between 17 and 25 years of age are more likely to use mobile phone while driving than older ones.

Also, it is more likely that driver would use his phone while waiting on traffic light at road intersection than while driving at speed of 100 km/h. The research found no difference in mobile phone usage regarding drivers who are not in a hurry or are turning late. Driving conditions have had more impact on the intent of using mobile devices while driving than the motivational factors of respondents [8].

The research made in United Kingdom - UK has shown that the combination of youth and inexperience poses a great risk to safety of young drivers. Young drivers need a high level of concentration on the current situation in traffic which makes them more prone to distraction risks. Also, young drivers use mobile devices while driving more often. Even 19% of young drivers are messaging at least once in a month while driving while older drivers are included in such activities in 11% of cases [9]. Unlike the UK, research from the USA shows even more disturbing numbers. Even 80% of young drivers in USA use a mobile device while driving to make calls, and 72% for writing messages [10].

In 2016, 32,757 traffic accidents occurred in Croatia [11]. However, the number of traffic accidents caused by using mobile phone while driving and the factors of phone usage affecting the traffic accidents remain unknown. The primary issue is a hardly possible subsequent identification of mobile phone usage as a main cause of the traffic accident. Participants of traffic accidents usually don't mention the use of mobile phone while driving and the associated distraction. Mentioned circumstances are the reason why Croatian police registers often don't contain accurate and/or detailed data on the

accidents caused by mobile phone usage. Drivers involved in passenger and transit traffic, including the truck and bus drivers, are also exposed to high safety risks due to the use of mobile device while driving. There is a space for improvement of the safety of for mentioned drivers, but in the Republic of Croatia it has been done very little. Due to insufficiently specified insight into the complexity of this problem and the lack of awareness of traffic participants, there is a need for an easily accessible and up-to-date information source where users form awareness of the negative impact of using mobile devices when driving [12], [13]. Proposed novelty should help in decreasing the number of people killed in traffic accidents for 50% by 2010 [14].

The fines are one of the methods used for raising the awareness about the negative impact of mobile phone usage while driving. Considering the fines are not most efficient methods, as stated by, it is necessary to act proactively in the terms of education [15], [16].

III. METHODOLOGY OF RESEARCH

The most prominent risk factors related to the problem of the impact of the use of mobile devices on driver behavior during driving covered by this research are:

- Today's employers such as carriers, taxi services, driver-renters and ordinary drivers imply the use of a motor vehicle as a mobile office, and assuming the significant use of mobile device while driving,
- The fact that trend of mobile devices owning also reflects in driving,
- Insufficient level of awareness regarding the problem,
- Irresponsibility of the wider community that is insufficiently informed about the problem,
- Lack of a national information portal for broader education, but also narrowly defined groups of users such as professional drivers, ordinary drivers as well as the employers,
- Inadequate engagement on prevention despite prescribed financial penalties (i.e. fines) and the fact that research has shown that this does not necessarily have a greater positive effect.

Considering previously mentioned this project's focus is directed to the research, dissemination of research results, education and the transfer of knowledge.

Research on the frequency of use of mobile devices while driving was carried out by the method of counting. Measurements are made at a few relevant locations in the city of Zagreb, Zagreb County and the city of Opatija.

Counting was made at city road points of higher traffic density, in different days of week and at different hours. The measurement was made on two different ways. One part of measuring is performed by project collaborators wearing project's official T-shirts who were therefore recognized as the project participants. Another part of measuring is performed by project collaborators dressed as common passengers (Figure 1).



Figure 1. Conducting of counting on two different ways

During the first way of measuring, drivers have easily spotted that something is going on and therefore have adjusted their behavior to unexpected circumstances. In the second way of measuring, drivers were completely unaware of conducted measuring and therefore haven't changed their behavior, i.e. drivers have used their phones more freely and therefore more of them was spotted.

The activities of presenting the results of the research, informing and drivers' education are conducted in: Autoclub Siget, Rijeka and Zadar, within the International Scientific Conference ZIRP-LST 2017, in the Ministry of the Sea, Transport and Infrastructure in Zagreb and on the seminar Technical analysis of traffic accidents 2017 at the Faculty of Traffic and Transport Sciences in Zagreb. Distribution of relevant information, i.e. informing of drivers is conducted on the city roads of Zagreb as well, in cooperation with several companies supporting the research labeled as the 'friends of the project'. Promotional materials, such as flyers containing educational information and facts, are frequently distributed.

The increasing number of tourists on state roads is defined as risk factor for traffic safety within the Country. Therefore, a special campaign has been prepared within the project to inform the tourists on dangers of mobile phone use while driving on social media and at toll station Lučko at the time of highest traffic in seasonal jams (Figure 2).

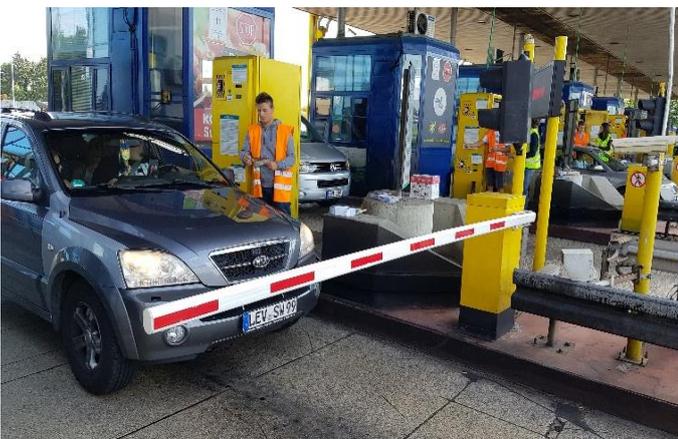


Figure 2. Informing the tourists at the Lučko toll station

Social networks are counting increase in the number of users daily and present a low-cost form of advertising and content sharing. Regarding to mentioned fact, this project is promoted through four most popular social networks in Croatia: Facebook, Instagram, Twitter and YouTube. In addition, there is an informative website of project formed to provide relevant information about the project, such as the overview of past and planned activities.

By promoting through Facebook social network, during the first 6 months, there were a very high number of 1,091,891 accesses to the project's Facebook page 'NE mobitelu u vožnji'. Out of the total number of accesses, the page has been assessed by 355,246 unique users. Many campaign posts were made, of which 18 were financially supported promotions. The results of the most successful campaign posts, ranked from the latest to the oldest, are shown in Table 1, and the image of A and B posts can be seen in Figure 3.

TABLE I. STATISTICS OF PROMOTING THROUGH FACEBOOK SOCIAL NETWORK

CAMPAIGN POST	NUMBER OF VIEWS	NUMBER OF REACTIONS, COMMENTS AND SHARES	NUMBER OF CLICKS
A	60,410	1,790	1,643
B	49,052	1,605	997
C	34,385	994	467
D	95,727	2,152	3,317
E	103,112	2,280	4,354
F	212,347	5,725	7,285



Figure 3. Image of A and B posts published in social networks (Facebook)

Four different surveys have been conducted on four different stakeholders, i.e. users:

- Domestic population - web questionnaire and field survey using the tablets on relevant locations,
- Taxi drivers – field survey using tablets and the help of interviewers in the rooms of taxi companies and associations (Figure 4),
- Rent-a-car users – field survey using tablets and the help of interviewers,
- Foreigners – web questionnaire adjusted to tourists that are having vacation in Croatia.



Figure 4. Conducting the survey among taxi drivers

By conducting the survey, the research gathered personal attitudes and experiences of the respondents on the use of mobile devices while driving.

IV. RESULTS

This paper contains preliminary results of counting the frequency of use of mobile devices and preliminary results of questionnaire on domestic population conducted within the first six months of project duration.

A. Results of counting the frequency of use of mobile devices

Since results obtained from questionnaires depend on the level of respondents' sincerity, the method of measuring the frequency of use of mobile device has given different results from ones obtained through questionnaires.

The Figure 5 shows locations of conducting measuring in Zagreb. Locations have been marked with letters from A to N, each containing the obtained percentage of drivers who were using their phone while driving.

According to results obtained by this method of research, drivers were using their phones while driving in 8.9% of cases. The usage frequency ranges from 5.6% (location G) to 13.3% (location D), in dependence of the part of the town. At the far north of the town (location B) and at the far east of town (location N) there is an equal number of noticed mobile phone users while driving (5.9%).

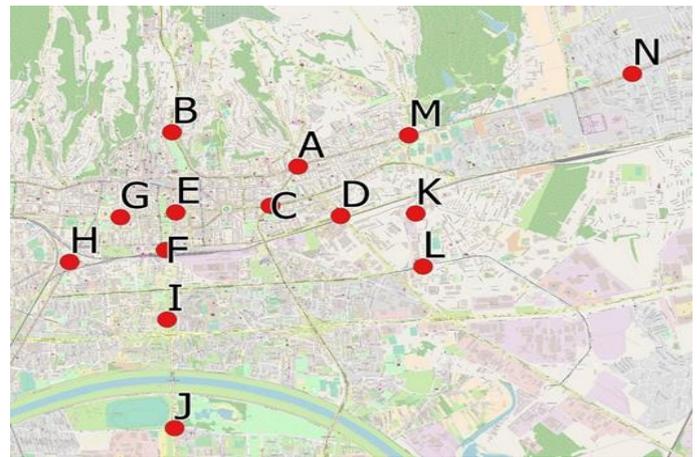


Figure 5. Locations of counting the frequency of use of mobile devices in Zagreb

Additionally, locations A and F show the frequency of usage of 9%, while locations L and M show 10.5%. Followed by location H with 10.2% of usage, the location I with 9.2%, the location C with 8.7% and the location K with 8.1% of usage. Also, there is undeniable percentage of usage in amount of 7.5% at the measurement point E (6.9%). The average rate of mobile phone usage is 8.6%.

B. Results of questionnaires on domestic population

The survey conducted on the entire state population through web questionnaire and a field survey on relevant locations in a six months duration has included 795 respondents. The most of respondents were between 18 and 25 years old (20%), and 13% of respondents were from age 25 to 29. Besides, 16% of respondents were 35 to 39 years old, 10% were 40 to 44 years old, and 6% were 55 to 59 years old. Among respondents, 70% were men and 30% were women.

Out of the entire set of respondents, 97% own driver's license and are drivers on daily basis. Only 3% of respondents do not use mobile phone for any kind of related activities while driving, and other 97% of respondents do.

The most of respondents who have confirmed to use mobile phone while driving use their phone when waiting at traffic lights (71%), while even 67 % of respondents uses mobile phone during the entire driving time.

Given the fact that traffic jams are common in city environment, 60% of respondents shorten their waiting time with their mobile phone, and 29% of respondents use their mobile phone when waiting at toll stations.

The Figure 6 shows the frequency of mobile phone usage while driving regarding individual mobile phone services. It is visible that 15% of mobile phone usage while driving is due to making phone calls, i.e. mobile conversation.

Also, interesting fact is that 89% of respondents claim to never play games on the mobile phone while driving.

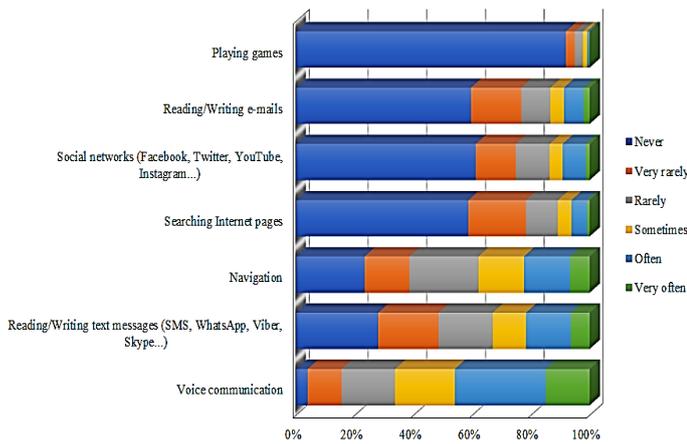


Figure 6. The frequency of mobile phone service usage while driving

Voice communication is still the main reason of using a mobile phone while driving (86%), and the navigation and texting (SMS, WhatsApp, Viber, Skype) are equally present (44%). Social networking is the reason why 15% of respondents uses their mobile phone, and followed by e-mailing with 13%. Playing of mobile games while driving isn't overly popular with respondents (1%).

The user's opinion on the impact of activities while driving shown in Figure 7 were also investigated, regarding making calls, using navigation or social networks. Respondents believe that gaming on a mobile device during driving significantly affects their reaction time (49%). In an equal percentage of 24% of respondents, searching the web, social networking and e-mailing is considered not to affect the time of drivers' reaction.

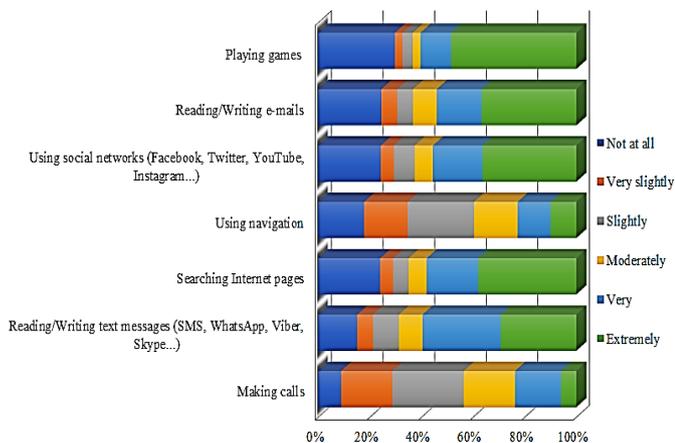


Figure 7. Considered effect of individual mobile phone activity while driving

Respondents are highly aware (91%) that their mobile phone usage while driving effects their own safety and the safety of other traffic participants, but the number of those who claim not to even think about it (4%) shouldn't be ignored. Since they are aware of the possible safety dangers, most respondents usually adjust the driving speed when using mobile phone behind the wheel (59%). Many respondents, up to 55%, believe that they can react quickly enough to the new

situation and that their use of mobile devices will not endanger the traffic. As many as 34% of respondents say they use handsfree because they are aware of the dangers, and 4% of users justify their behavior claiming the others use their phone while driving as well, i.e. claim to follow the example of other drivers.

Many respondents (72%) believe that legal sanctions regarding the use of mobile devices while driving should be stricter. Higher fines would greatly encourage respondents not to use mobile devices while driving (20%). 28% of respondents find that they would be much encouraged by a stricter law and dense police control. The education about the negative effect of using mobile devices while driving is found relevant by 15% of respondents.

V. DISCUSSION AND CONCLUSION

The use of mobile device while driving is one of the many types of driver distraction and is considered a new era disease. Given the fact that activities such as telephony, writing messages or browsing websites require visual, sound and cognitive attention of drivers, the road traffic safety is compromised. The official publicly available national statistical database has identified main causes of traffic accidents. However, there are causes that are not easy to record, such percentage of the use of all types of mobile devices while driving.

Many worldwide conducted studies show that a large majority of drivers regularly use mobile devices while driving. Drivers are aware of the dangers that may occur, but continue with the usage of mobile phone in traffic. Young and inexperienced drivers belonging to the online generation are considered the riskiest driver group. This lies in the fact that they use the most sophisticated applications, read and write messages, take photos and make videos while driving, also it takes more time for them to react then for experienced drivers.

In addition to the financial penalties used by many states, drivers need to be educated about the dangers and consequences of using mobile devices while driving.

Presented questionnaire results show that 97% of drivers in Croatia use their mobile phones while driving. The results of counting have given results of 8,9% of drivers who use their phone behind the wheel. Respondents most often use their phone for talking behind the wheel, while texting is considered to noticeable affect the time of reaction. Stricter law, higher fines, more dense police control and higher level of education are considered to encourage reduction in the use of mobile devices while driving.

The obtained results indicate the necessity of further research on the issue of using mobile devices while driving to increase driver awareness and the traffic preventive.

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