

QUESTIONNAIRE SURVEY OF THE SKILLS OF WATER TENDER DRIVERS AT THE FIRE RESCUE SERVICE OF THE CZECH REPUBLIC

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Research article

Abstract: The paper summarizes results of the study aimed to evaluate the change of firefighters-engineers' driving skills after attending the one-day training course. The research focused at drivers of firefighting water tenders. These trucks represent the first-response vehicles in case of emergency rides. The water tenders form the majority of firefighting vehicles at units of the Fire Rescue Service of the Czech Republic with the highest mileage per year. They represent the most important fire appliances at each professional fire station. Water tender drivers' primary task is to transport both firefighters and vehicles safely without any traffic accident to the intervention point. Therefore, the drivers should acquire the best driving skills. The results of the survey shows both a positive impact of the course - driving skills improved after passing the course, and a negative finding - the insufficiently short duration of training rides on the polygon. Drivers' skills were examined after a certain time from passing the course. This third phase of our survey showed that "avoiding a sudden obstacle when emergency driving" occurred as a most frequent critical situation. This fact relates with the most frequent cause of firefighting trucks' traffic accidents in last four years, according to the Statistics of traffic accidents.

Keywords: Drivers, firefighting vehicles, traffic accident, safety, critical situation.

Introduction

The intervention ride which aims to eliminate the emergency by the Integrated Rescue Service (IRS) units is based on three system elements: *the human being - the machine - the environment*. The fire truck driver - as a human factor of the system - is the basic and the most important element of the systemic investigation of the firefighting vehicles safe drive. People cannot influence the environment (such as weather or road quality). The safety parameters of the machine - the firefighting vehicle in our case - are determined by its manufacturer. Moreover, the driver of the firefighting vehicle is not the person who takes a decision on the quality and characteristics of the purchased vehicle. Nevertheless, if we are able to improve firefighters' driving skills steadily,

the drive would be safer. The three-year project "*The Professionalization of Integrated Rescue Service Drivers of the Czech Republic*" focused on the analysis of driving skills improvement. The project lasted from 2016 to 2018. The content of the project was constituted by the special course of the safe driving for approximately 5.500 members of the Fire Rescue Service of the Czech Republic (FRS CR) combined with the solution of demanding driving situations. The project was realized on six polygons in the Czech Republic - Vysoké Mýto, Most, Příbram, Sosnová, Jihlava and Ostrava. The courses were designed as an intensive 8-hour exercise within one day. The 2-hour theoretical preparation followed by 6 hours of a practical ride on the polygon. The drivers practiced there:

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- maneuvering the vehicle in a limited space,
- braking on different surface types in both straight direction and in turns,
- obstacle-avoidance manoeuvres,
- managing the vehicle while skidding,
- the dynamic driving through the crossing,
- to cope with driving under aquaplaning.

These courses were designed to prepare the drivers to deal with critical situations on the roads and to ensure a safer and faster transport of IRS units to the emergency point (Kopanicová and Adámek, 2011).

Materials and methods

The main objective of our research was to find out the impact of attending the course on the skills and abilities of emergency firefighting drivers. One of the quantitative methods - the questionnaire survey - was selected as a survey tool (Gavora, 2010).

Between October 16 and October 26, 2017, 7 courses were held for fire-engineers - water tender drivers at FRS CR. Within the courses attended by a total of 104 firefighters, a questionnaire survey took place. Participants came from 7 regions: Central Bohemian, Karlovy Vary, Pardubice, Hradec Králové, South Moravian, Zlín and Moravian-Silesian Region.

The questionnaire survey was divided into 3 phases:

- Phase I - before completing the course. That part of the survey focused on the current driving skills. The questionnaire survey took place just in the beginning of the course, before the theoretical education started.
- Phase II - after completing the course. That investigation was carried out immediately after finishing the practical part of the course. The survey focused on identifying potential improvements in the driving skills of the course leavers.
- Phase III - after several months from the end of the course. This phase started in January, 2018. It was aimed at verifying the driving abilities that the participants gained during the course and used them in their daily practice while emergency drives.

In winter season we could usually observe an increase of critical situations caused by severe climatic conditions and by their impact on the road surface. The investigation continued during the first half of the year 2018 and was closed in the end of May, 2018. That phase was more time-consuming and organizationally more demanding part of

the survey. The research required communication with commanders of selected fire stations to choose only those drivers who passed the course "*The Professionalization of Integrated Rescue Service Drivers of the Czech Republic*" and among them those who were willing to share their experiences. Unfortunately, some negative-access drivers occurred even at the beginning of the questionnaire survey.

Questions from the various phases of the survey were summarized in the following chapters. The first two questions were the same in all types of questionnaire forms. The drivers' age and the duration of their practice were detected due to the primary categorizing the drivers.

Questions of the Questionnaire Survey - Phase I

- I.1 The age of the driver.
- I.2 The practice duration in truck driving at FRS CR.
- I.3 How would you evaluate your driving skills as a firefighting truck driver at the FRS CR while driving in critical situations?
- I.4 Which of the followings describes in the best way your expectations of the course attendance?
- I.5 As a fire truck driver, I went through a critical situation when braking on a low-adhesive road and I was able to cope with that:
- I.6 As a fire truck driver, I went through a critical situation in obstacle-avoidance maneuvering and I was able to cope with that:
- I.7 As a fire truck driver, I went through a critical situation when skidding and I was able to cope with that:
- I.8 As a fire truck driver, I went through a critical situation when riding under aquaplaning and I was able to cope with that:

Questions of the Questionnaire Survey - Phase II

- II.1 The age of the driver.
- II.2 The practice duration in truck driving at FRS CR.
- II.3 Which of the followings describes in the best way your gains from attending the course?
- II.4 How would you evaluate your driving skills after attending the course when driving in critical situations?

How would you evaluate the change of your driving skills after attending the course with respect to cope with following critical situations?

- II.5 braking on the low-adhesive road in the straight direction:
- II.6 avoiding a sudden obstacle:
- II.7 driving while skidding:
- II.8 riding during the aquaplaning:

Questions of the Questionnaire Survey - Phase III

- III.1 The age of the driver.
- III.2 The practice duration in truck driving at FRS CR.
- III.3 Have you had any experience with driving in a critical situation after attending the course?
- III.4 In the case of a YES answer to question 3, please specify the type of the critical situation. Otherwise, do not fill out.

How would you evaluate your driving skills in the critical situations after some time from attending the course "The Professionalization of Integrated Rescue Service Drivers of the Czech Republic":

- III.5 braking on the low-adhesive road in the straight direction:
- III.6 avoiding a sudden obstacle:
- III.7 driving while skidding:
- III.8 riding during the aquaplaning:

Results

Answers to questions of the different questionnaire survey phases are discussed in the following chapters. Since the first two questions are the same in Phase I and II, these questions were evaluated only once. Each evaluated answer is presented in the graph by the question in the chart title, the answers, the absolute number of answers and the percentage of the particular answer of the total 104 participants. In the Phase III answered only 50 respondents.

Evaluation of the Phase I results

The results of the first part of the questionnaire survey are shown in the following graphs in Fig. 1 to Fig. 8.

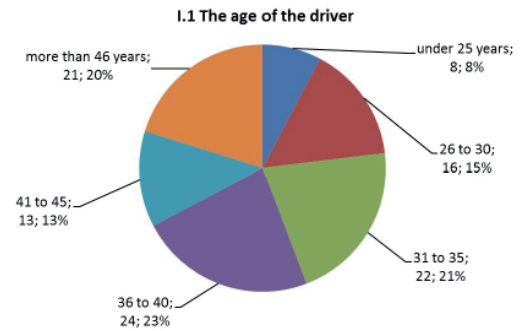


Fig. 1 The age structure of respondents

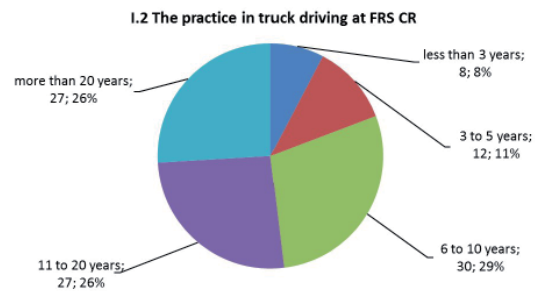


Fig. 2 The experience in truck driving at FRS CR

I.3 How would you evaluate your driving skills as a firefighting truck driver at the FRS CR while driving in critical situations?

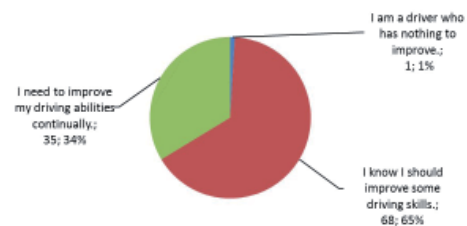


Fig. 3 The self-evaluation of driving skills while driving in critical situations

I.4 Which of the followings describes best your expectations from the course attendance?

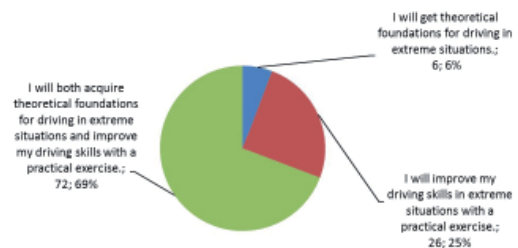


Fig. 4 Driver's expectations about improving driving skills

I.5 As a fire truck driver, I went through a critical situation when braking on a low-adhesive road and I was able to cope with that:

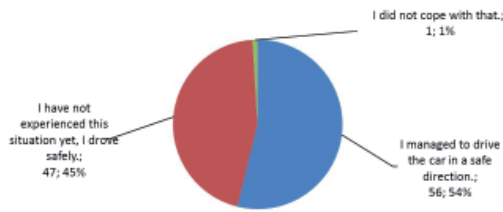


Fig. 5 Cope with critical situations while braking on a low-adhesive road

I.6 As a fire truck driver, I went through a critical situation in avoiding a sudden obstacle and I was able to cope with that:

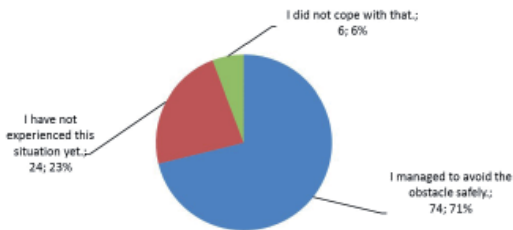


Fig. 6 Manage critical situations while avoiding a sudden obstacle

I.7 As a fire truck driver, I went through a critical situation when skidding and I was able to cope with that:

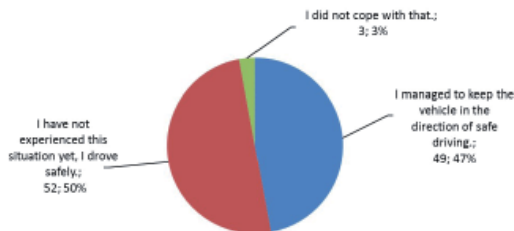


Fig. 7 Cope with critical situations while skidding

I.8 As a fire truck driver, I went through a critical situation when riding an aquaplaning vehicle and I was able to cope with that:

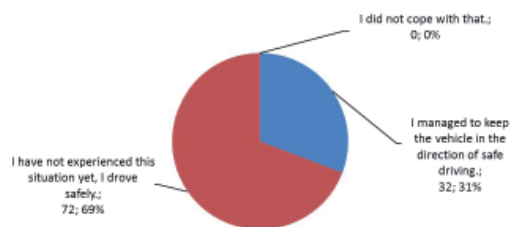


Fig. 8 Manage critical situations while driving under aquaplaning

Evaluation of the Phase II results

The results of the second phase of the survey are shown in the following graphs in Fig. 9 to Fig. 14.

II.3 Which of the followings describes in the best way your gains from attending the course?

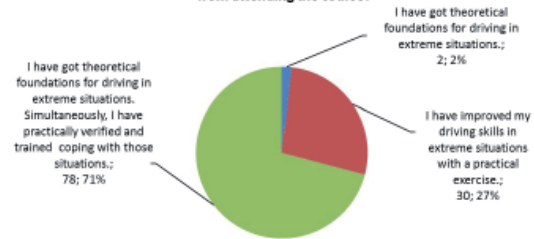


Fig. 9 Self-evaluation of the increase of the driver's benefit after finishing the course

II.4 How would you evaluate your driving skills after attending the course when driving in critical situations?

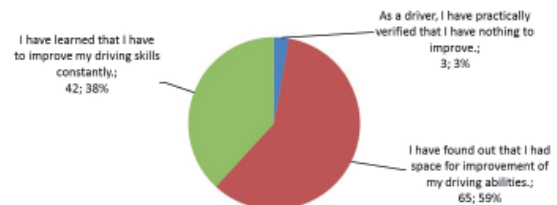


Fig. 10 Self-evaluation of the driver's skills improvement after finishing the course

II.5 How can I manage braking on a low-adhesive road after attending the course

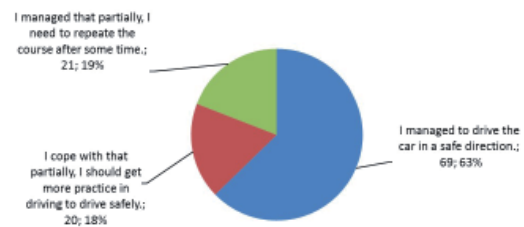


Fig. 11 Self-evaluation of the driver's skills improvement while braking

II.6 How can I cope with avoiding a sudden obstacle after attending the course

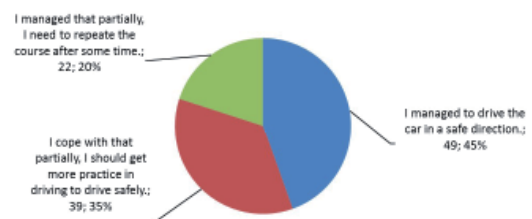


Fig. 12 Self-evaluation of the driver's skills improvement during the obstacle-avoidance maneuver

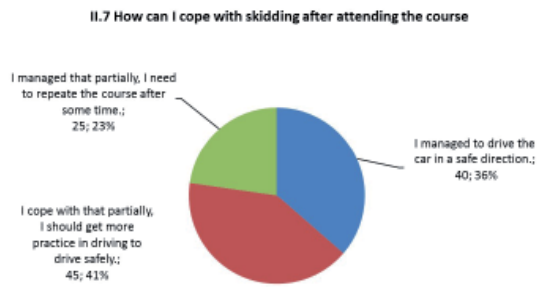


Fig. 13 Self-evaluation of the driver's skills improvement while skidding

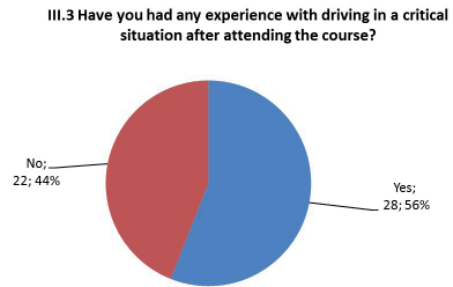


Fig. 17 The experience with driving in critical situations

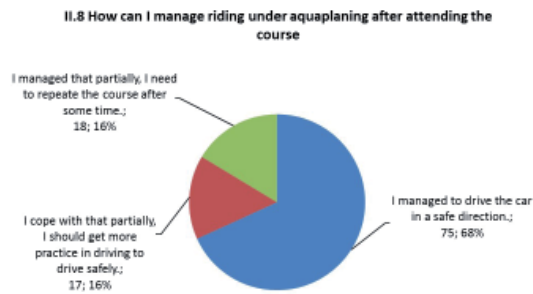


Fig. 14 Self-evaluation of the driver's skills improvement while driving under aquaplaning

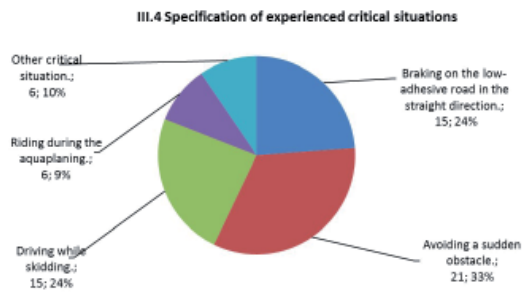


Fig. 18 Specification of experienced critical situations

Evaluation of the Phase III results

The results of the third phase of the survey are shown in the following graphs in Fig. 15 to Fig. 22.

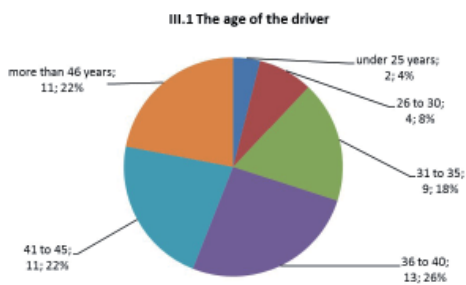


Fig. 15 The age structure of respondents

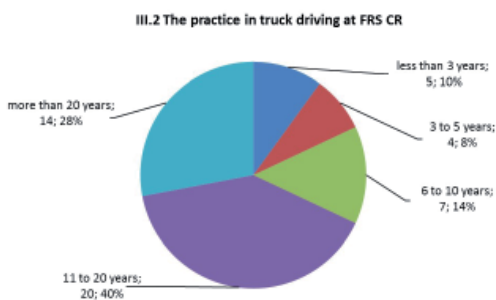


Fig. 16 The experience in truck driving at FRS CR

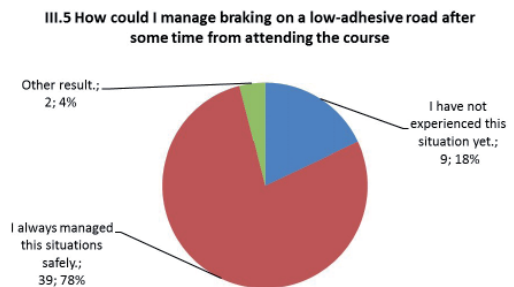


Fig. 19 The ability to manage braking on a low-adhesive road

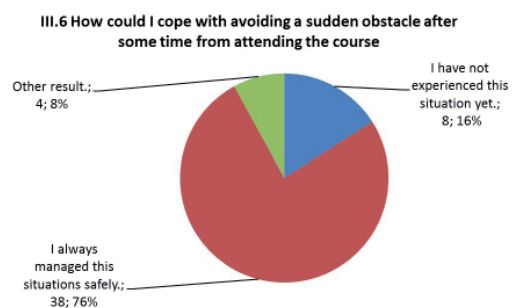


Fig. 20 The ability to avoid a sudden obstacle

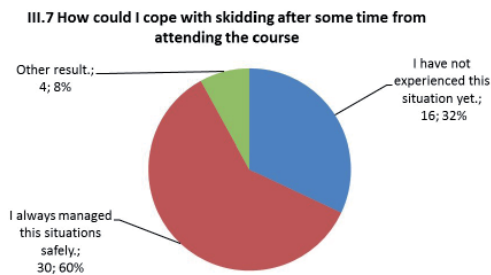


Fig. 21 The ability to manage skids

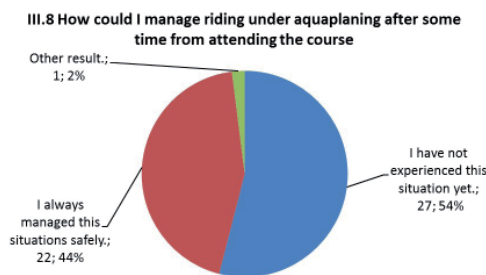


Fig. 22 The ability to manage aquaplaning

Summary of the current results of the questionnaire survey

The evaluation of the questionnaire survey results is divided into two parts. Firstly, the survey Phase I and II are evaluated, as they used an identical structure of respondents as mentioned in the introduction. The second part of the results describes the Phase III of the survey.

During the survey Phase I and II was the age structure of the participants - the respondents of the questionnaire survey - made up of almost 60% experienced drivers aged over 36 years with the practice of truck driving at the HZS CR longer than 10 years.

Subsequent results of the survey Phase I - managing selected critical situations while driving a fire truck - corresponded to this structure of respondents. 6% of respondents did not manage

only one of all defined critical situations (see Fig. 6). Other responses showed that drivers drove safely or predictably, or were able to handle critical situations.

In particular, drivers had to evaluate the acquired skills in Phase II of the questionnaire survey. Here, 59% of respondents found the course to be beneficial. At the same time, the requirements for repeating the course and gaining more hours of practical rides prevailed in the responses.

In the survey Phase III, the age structure of respondents was composed by 70% of experienced drivers aged over 36 years and with the practice in truck driving at the HZS CR over 10 years. That was 10% more than in the previous two survey phases. Older and more experienced drivers were more interested to participate in our survey. Of the total 50 respondents, 28 (56%) passed at least one of the critical situations after completing the course (question III.3). Only these 28 respondents answered the following question III.4. The matrix of their responses is shown in Tab. 1. The digit 1 represents a positive selection of the current critical situation.

It is evident that 12 drivers (43%) experienced only one critical situation and three drivers passed maximum 5 defined critical situations. Others experienced more than one and less than five defined critical situations. The respondents experienced 63 critical situations in total. The distribution of the number of experienced critical situations is shown in Fig. 23.

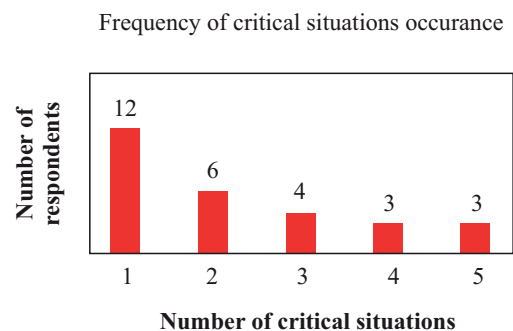


Fig. 23 The distribution of the critical situations experienced by respondents

Tab. 1 Summary of responses to the question No. III.4

III.4 In the case of a YES answer to question 3, please specify the type of the critical situation																						
a)	Braking on the low-adhesive road in the straight direction	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
b)	Aavoiding a sudden obstacle		1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
c)	Driving while skidding			1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
e)	Riding during the aquaplaning				1			1	1		1			1				1				
e)	Other critical situation						1	1								1	1			1	1	

From the experienced critical situations, the answer B) "Avoiding a sudden obstacle" was the most frequently chosen. This situation was experienced by 21 respondents (75%). The same 15 occurrences followed by the answers A) „Braking on the low-adhesive road in the straight direction" and C) "Driving while skidding". All of these three critical situations were experienced by 10 respondents (36%). These answers point to the greatest risks a firefighting truck driver may encounter while driving.

Questions III.5 to III.8 focused on the subjective assessment of the selected driving skills of the respondents when driving a fire truck. Out of the 50 respondents, 2 to 8% reported the "Other result" response for the described model situations. This may also be the case when the driver was not able to handle safely a situation that did not currently seem as a critical one. This state of current driving skills can be illustrated by trends in the traffic accidents development among fire truck drivers (Šnelly, 2011; Bíla, 2012, Bíla, 2013; Tajovský, 2014; Hanuška, 2015; Hanuška, 2016; Hanuška, 2017; Hanuška, 2018). Fig. 24 shows selected traffic accident statistics for firefighting water tenders. The resulting trend of the traffic accidents number is, unfortunately, very likely (94%) still increasing. Results of 2018 statistics are not published, since the latest data have not been evaluated yet.

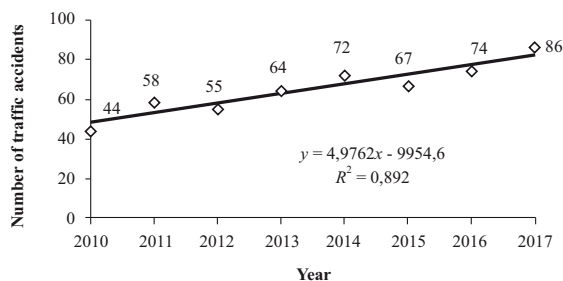


Fig. 24 Traffic accidents trend for firefighting water tenders

This is also related to the increasing damage to fire vehicles, health and life. Fig. 25 summarizes statistics on total damage to fire trucks in traffic accidents (Šnelly, 2011; Bíla, 2012, Bíla, 2013; Tajovský, 2014; Hanuška, 2015; Hanuška, 2016; Hanuška, 2017; Hanuška, 2018).

In more detail, damage to firefighting water tenders was described in the paper (Jánošík et al., 2018). We can believe that in a longer time period due to the continuous repetition of similar courses in the particular regions, this unfavorable trend will turn to better results.

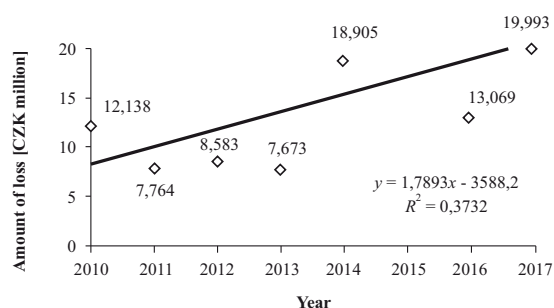


Fig. 25 Trend of total loss in firefighting trucks traffic accidents

Conclusion

After making the brief summary of the provable survey Phase I and II results we can see two visible extremes:

- a positive impact of the course - driving skills improved after passing the course,
- a negative finding - the insufficiently short duration of training rides on the polygon.

The most often experienced critical situation "Avoiding a sudden obstacle" during the intervention drive emerged from the Phase III survey results despite the fact the respondents were likely to remember the experienced critical situations from the winter season 2017 - 2018 than from the summer 2017, when completing the questionnaire.

Acknowledgments

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References

- Bíla, J. 2012. Analysis of Traffic Accidents at Fire Rescue Service Units in 2011. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-41889-1/PO-IZS-2012, 28 p. (in Czech)
- Bíla, J. 2013. Analysis of Traffic Accidents at Fire Rescue Service Units in 2012. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-43354-1/PO-IZS-2013, 27 p. (in Czech)
- Gavora, P. 2010. Introduction to pedagogic research. 2nd ed. Brno: Paido, 261 p. ISBN 9788073151850. (in Czech)
- Hanuška, Z. 2015. Analysis of Traffic Accidents at Fire Rescue Service Units in 2014. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-71103-1/PO-IZS-2015, 24 p. (in Czech)
- Hanuška, Z. 2016. Analysis of Traffic Accidents at Fire Rescue Service Units in 2015. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-47258-1/PO-IZS-2016, 25 p. (in Czech)
- Hanuška, Z. 2017. Analysis of Traffic Accidents at Fire Rescue Service Units in 2016. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-45933-1 /PO-IZS-2016, 27 p. (in Czech)
- Hanuška, Z. 2018. Analysis of Traffic Accidents at Fire Rescue Service Units in 2017. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-29552-4/PO-IZS-2018, 29 p. (in Czech)
- Jánošík, L., Jánošíková, I., Cochlar, M., Jemelík, S. 2018. Economic Aspects of Firefighting Vehicles Safe Driving within EU Civil Protection. In: Staníčková, M., Melecký, L., Kovářová, E. Proceedings of the 4th International Conference on European Integration 2018: ICEI 2018: May 17-18, 2018, Ostrava, Czech Republic. 1st part. Ostrava: VŠB - Technical University of Ostrava, p. 556-565. ISBN 978-80-248-4169-4.
- Kopanicová, A., Adámek, I. 2017. Professionalization of drivers of IRS CR. Magazine 112. Vol. XVI. No. 2/2017. p. 35 (in Czech)
- Šnelly, L. 2011. Analysis of Traffic Accidents at Fire Rescue Service Units in 2010. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-62721-1/PO-IZS-2011, 28 p. (in Czech)
- Tajovský, M. 2014. Analysis of Traffic Accidents at Fire Rescue Service Units in 2013. Praha: Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic. No. MV-43354-2/PO-IZS-2013, 27 p. (in Czech)