

# FATAL COSEQUENCES IN TRAFFIC ACCIDENTS WITH TRACTORS IN THE AGRICULTURE OF REPUBLIC OF MACEDONIA

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## Abstract

*This paper presents the research results of fatal consequences in traffic accidents with tractors in the agriculture of Republic of Macedonia. Herewith we research the causes of accidents that led to fatal injuries by farmers in agricultural production. According to the research carried out in the period from 2008 till 2012 in accidents with tractors, 47 people have been killed. The most common cause of accidents is inadequate speed of movement and real road conditions, and often tragic consequences as a result of a mutual crash of vehicles and tractor's rollover.*

**Key words:** tractor, accidents, crash, rollover, fatal consequences

## 1. Introduction

Modern agricultural production in terms of exploitation, poses considerable demands in relation to machinery (tractor) and in relation to the human user. The reasons for this are the complexity and interaction of agro-technical, meteorological and biological conditions that accompany agricultural production.

A number of factors that affect the operation and safety of the use of tractor-machine sets (TMS) and their correlation, impede implementation of agricultural technology in various places and conditions. For that reason, there is a large number of accidents which often end in tragedy.

Today, agricultural production can not be imagined without the use of modern agricultural machinery, and a carrier that has the widest use in agriculture is a tractor. However, in many circumstances, according to [1], [2], [3] tractors are potentially very dangerous traction-drive machine, especially if they are not used in accordance to certain technical safety rules [7], [16] prevention and care [8] and certainly the traffic laws and technical regulations.

Car accidents involving farm machinery on public and rural roads represent a serious problem in most of the states of America [30]. Based the researches on survey reports of traffic accidents in different states of America, it is concluded that accidents involving agricultural machinery, are almost commonplace.

The man who operates the tractor, and regulate attachment units, is exposed to many different influences [11], especially the effects of extreme temperatures, excessive noise, vibration, emissions. All mentioned have a dangerous effect on the tractor operator and can cause a number of disorders in the body. Physiological fatigue of tractor operator is one of the most important sources of reduced security. The operators often spend a full day (10 hours or more per day) working with the tractor, strenuous work. Longer working hours, in interaction with the listed negative effects (which lead to rapid operator fatigue) are often associated with the risk of accidents. Workplaces (fields, meadows, forests, etc...) are distant from the place of residence, which may influence the occurrence of accidents. Tired tractor drivers returning home, are going on public (often main) roads meeting with (faster) vehicles. Fatigue and the influence of alcohol used by tractor drivers, technical malfunction tractors, large differences in speed and other factors contribute to the increased risk of traffic. It should be noted that the above happens in the evening and at night, and the failure of light-signaling devices specifically causes of road traffic accidents in Macedonia.

With the development and implementation of many positive effects, tractors and other agricultural machinery, the researchers in their work and literature data show tractor undoubtedly one of the main causes of the various types of injuries and accidents, with different and even tragic consequences.

For example, according to data [7], [18], [28], in the last 10 years, directly in agricultural production in the United States the average of 800 people are annually tragically hurt, 14 in Finland, 31 in Ireland, 35 in Slovenia in Serbia 75 operators or users of agricultural machinery.

Likewise, much of the research presented in the world literature confirms that in every tragic case comes up to 40 injured farmers (heavy and light injuries, disabled workers with the traumatic consequences of different levels of social problems). According to a study from 1999 [27], an average of 21 adult a year are killed in the agriculture of Florida (USA). The most common types of accidents in this research is overturning tractor. In the U.S., 36% of accidents in agricultural production, are as a result and a consequence of improper operation of tractors, while in 19% of accidents causes are other agricultural machinery.

Injuries and accidents with tragic consequences with participation of men and tractors in the Republic of Macedonia are the critical point of agricultural production. According to data from the Central Bureau of Statistics [24], Clinical Center [23] and MIA [21] in Republic of Macedonia, in the period from 1993 to 2003 the average of 14 people die in traffic accidents with tractors annually. Also, in accidents with tractor working on average 9 people are killed, 5 were tractor drivers and four passengers on the tractor or trailer.

Today, much attention is devoted to the safety, security and raising the technical education of farmers working with machines in the world. However, accidents with tractors and other agricultural machinery [17] and continue to occur as a result of improper handling, disregard of basic traffic rules, mental and physical fatigue, malfunctioning machines and the like. Poor training of farmers (especially operators of agricultural machinery) because there is no permanent training and supporting professional - popular courses for the proper use and maintenance of tractors and other agricultural machinery, has a direct impact on the number of accidents with severe and fatal consequences in agriculture in Macedonia.

## 2. Materijals and metods

Accidents and injuries with fatal consequences for farmers in the public transport of Macedonia, were analyzed for a period of five years, 2008-2012 in the following areas:

- transport operations in public transport on the roads in Macedonia with a participation of a tractor and a trailer
- Data on fatalities [21], [23], [24] were obtained from the Central Bureau of Statistics, Ministry of Interior of R. Macedonia, Clinical Center and health institutions in the period from 2008 to 2012. Records and data of these institutions were used to collect data on the tragic fatalities in agricultural production. The survey data are tabulated and plotted by year, causes and consequences of an accident, and then analyzed.

## 3. Results and discussion

In agricultural production while using a tractor, directly in the field or in the public transport, a large number of accidents are happening [18], [23], [24]. Unfortunately, as a result in these accidents farmers, mostly have a serious injury, or those are injuries with tragic consequences. Thus, for example, [19], in the period from 1980 to 1988 in agricultural production in the Republic of Serbia in tractor accidents, 900 tractor operators have been killed, or an average of 112 a year. According to the literature data, in the United States [25], [33], the average in the agricultural production are

1300 accidents which occur per year with tragic consequences, and 120,000 accidents with severe injuries.

During the research period in Republic of Macedonia from 2008 to 2012, in accidents involving tractor 819 persons have been injured, of which 47 (5.74%) died, 168 (20.51%) people were seriously injured and 604 (73.75 %) were easily injured in traffic accidents with tractors on public roads (Table 1).

**Table 1.** *The consequences of accidents with tractors*

Year	Killed	Seriously injured	Easily Injured	Total injured/dead
2008	13	35	106	154
2009	6	33	104	143
2010	7	34	106	147
2011	8	35	167	210
2012	13	31	121	165
<b>Total</b>	<b>47</b>	<b>168</b>	<b>604</b>	<b>819</b>
<b>%</b>	<b>5.74</b>	<b>20.51</b>	<b>73.75</b>	<b>100</b>

If we analyze the causes of accidents that led to the death consequences (Table 2) it can be concluded that in road accidents with the participation of tractors on average 9.4 people die per year and the largest number of 27 (57.45%) people died tragically due to non-compliance with traffic signs and regulations. As a result of poor psycho-physical condition and pedestrians and passengers errors and technical malfunction of the vehicle 12 (25.53%) and 8 (17.02%) individuals were killed.

**Table 2.** *Total number of people killed in a tragic road accident with tractors, 2008-2012*

Consequences	Causes of accidents			Total
	Disrespect of traffic signs and regulations	Psycho-physical state	Pedestrian and passengers errors and vehicle technical malfunction	
<b>Dead</b>	27 (57,45%)	12 (25,53%)	8 (17,02%)	<b>47</b>
<b>average (5 years)</b>	5,4	2,4	1,6	<b>9,4</b>

The largest number of people 15 (55.56%) was tragically killed as a result of speeding, movement which is not in accordance to traffic signs and road conditions (Table 3). A number of people 6 (22.22%) were tragically killed due to improper movement and 3 (11.11%) individuals were killed due to priority passing. The minimum number of people 1 (3.70%) tragically died as a result of tractor operator errors when stopping and parking the vehicles.

**Table 3.** *Tragically killed people in road accidents with tractors*

Year	Causes of accidents						Total
	Interrupted speed	Irregularly passing	Improper passing	Improper movement	Disregard priority	Stopping and parking	
2008	1	0	0	3	2	0	6
2009	3	0	0	0	0	0	3
2010	1	1	0	0	0	0	2
2011	4	0	0	1	0	1	6
2012	6	1	0	2	1	0	10
Total dead	15	2	0	6	3	1	27
Average	3	0,4	0	1,2	0,6	0,2	5,4
%	55,56	7,41	0	22,22	11,11	3,70	100

Tractor operator errors that occurs as a result of psychological factors, physical condition (alcohol or drugs consuming, fatigue, illness, physical and psychological deficiencies, etc.) and lack of

experience in managing a tractor and other motor vehicles have led to the occurrence of accidents with tragic consequences in which 12 people was tragically killed (Table 4).

**Table 4.** *Tragically killed people in road accidents with tractors*

Year	Causes of accidents			Other mistakes	Total
	Psycho-physical state		Insufficient experiences		
	Alcohol	Other causes			
2008	1	3	1	0	5
2009	1	0	1	0	2
2010	1	0	1	0	2
2011	0	0	1	0	1
2012	1	0	0	1	2
Total dead	4	3	4	1	12
Average	0,8	0,6	0,8	0,2	2,4
%	33,33	25	33,33	8,33	100

According to the survey (Table 4) it can be concluded that as a result of these causes of accidents, the majority of people 7 (58.33%) are tragically hurt because of poor psycho-physical condition of the tractor operators and drivers of motor vehicles.

In road accidents as a result of alcohol consumption was tragically killed 4 (33.33%) people was tragically killed and due to other causes that have led to an unstable psycho-physical condition and have a direct impact on the concentration and reaction speed of the operator or driver another 3 (25,00%) people have been killed. The negative impact of psycho-physical condition of the operators and drivers of other vehicles on the security and the number of people killed in road accidents cited by other authors in studies [19].

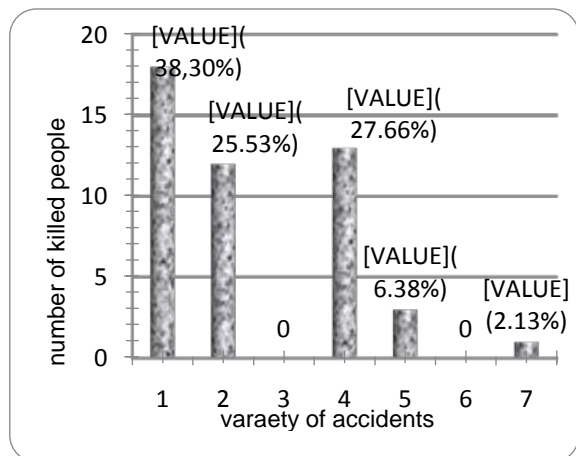
Accidents which are a result of the inexperienced driver and tractor operator in the managing of motor vehicles has led to tragic consequences in 4 (33.33%) individuals, and the unexplained causes of accidents killed one more 1 (8.33%) individual.

**Table 5** *Tragically killed in traffic accidents with tractors*

Year	Errors - Mistakes		Technical Vehicle Malfunction	Total
	Pedestrians	Passengers		
2008	0	1	1	2
2009	0	0	1	1
2010	0	0	3	3
2011	0	0	1	1
2012	0	1	0	1
<b>Total dead</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>8</b>
<b>Average</b>	<b>0</b>	<b>0,4</b>	<b>1,2</b>	<b>1,6</b>
<b>%</b>	<b>0</b>	<b>25</b>	<b>75</b>	<b>100</b>

Beside the operators of agricultural machinery and motor vehicles, causes of traffic accidents are: pedestrians and passengers errors, and vehicles technical malfunction. As a result of these causes 8 people was tragically killed (Table 5). According to the survey (Table 5), it can be concluded that due to technical vehicles failure, 6 (75.00%) individual have been killed. The table shows 2 more people who died in the accident and that they were passengers on a tractor.

Comparing causes of traffic accidents of tragically killed people, with the types of accidents with tractors (Figure 1) it can be stated that the maximum of 18 people (38.30%) have died tragically as a result of the collision of motor vehicles and tractors. As a result of tractor roll-over, and landing tractors off the road, a total of 13 people (27.66%) are recorded and 12 (25.53%) injured people are from the other types of accidents which is the highest recorded death of road accidents.



**Fig. 1.** Number of people killed in road accidents with tractors in the period 2008 - 2012

- 1 - Vehicles collisions
- 2 - Landing off the road
- 3 - The fall of the tractor-trailers
- 4 - Tractor roll-over
- 5 - Trampling tractor
- 6 - Impact of tractors in hard surface
- 7 - Impact tractor and parked vehicle

The average age of the tractors in the Republic of Macedonia is 26 years [24], and the older amortized tractors (often with a faulty system for steering and braking, faulty warning lights, etc..) do not have built-in safety cab or frame, and no other security electronic devices which control the position and tractor work. In such a situation, serious injuries and even fatalities, injury to the operator or passenger of the tractor (which are driven mostly on the bumper or stand in the rear of the tractor without the possibility of protection) are inevitable.



**Fig. 2.** Overturning of a tractor with tragic consequences

#### 4. Conclusion

According to the findings of the tragic consequences in road traffic accidents with tractors in agriculture of the Republic of Macedonia from 2008 to 2012, it can be concluded:

During the research period in road accidents with tractors 819 people have been injured.

In accidents involving tractors, 47 people have been killed tragically.

According to the type of traffic accidents, the most tragic consequences are as a result of:

- Mutual vehicle collision (18 people)
- Tractor roll-over (13 people)
- Landing the tractor off the road (12 people).

The tragic consequences of road traffic accidents with tractors, often are results of these causes:

- Speeding and inadequate movement on the road in accordance to the real conditions (15 people)
- Poor mental and physical condition (alcohol, drugs, illness, etc.). (8 people)
- Technical vehicle malfunction (6 persons).

In the agriculture in the Republic of Macedonia the average age of tractors is over 26 years, and they are often technically incorrect, no cab or protective frames, and all these is correlated with the disregard of legal regulations and the lack of information and training of tractor operators, which inevitably leading to more accidents and tragic consequences in agriculture.

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