

## THE RISK RATE BY ADR ROAD TRANSPORT OF DANGEROUS MATTERS

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The paper will be focused on the questions of ADR road transport of dangerous matters, especially on the risks estimation of transport of dangerous goods in the Czech Republic. The risks estimation is the basic presumption for safety increment by this type of risk transport. The aim of the paper is to refer to the risks, which may occur not only in the case of traffic accidents, but also by influence of the various logistics activities. There is also an endeavour to minimization of these risks in the paper.

**Key words:** road transport, risk, dangerous matters

### 1 Introduction

There were markedly increasing hauling performances of road transport in last decades. It is caused by plenty of reasons, but first of all by the fact that the time of conveyance and the transport costs are preferred and minimized by customer. The “door-to-door” type of transport and the safety of goods by transport are preferred by customer next to it. The growth of volume of road transport substituting railway transport is also caused by named reasons. There are also some other rising-up negative effects connected to this growth like pollution, congestions, traffic accidents, unloaded drives etc.

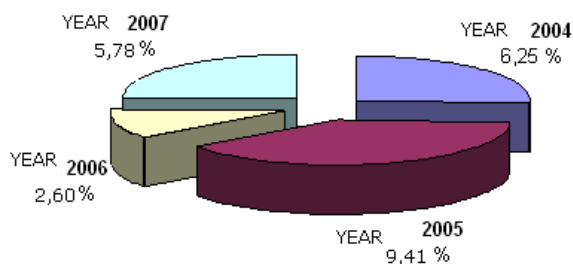
In spite of the fact that this sphere is rather discussed, there is often existed dependence on the type of transported goods. This fact is also able to make matters worse and to increase the negative effects caused by transport. The transport of dangerous goods is just one of these cases.

### 2 Presumptions for ensuring of security

In the Czech Republic the transportation of dangerous substances is mostly realised by road and rail transport. The accident frequency is manifold superior to the rail transport and the risk of accident of vehicle loaded with dangerous substances (picture 1) is naturally higher than risk of rail-accident in the same case. By these types of accident, there are dangerous substances spontaneously leaked away from can package or trailer body. In case of this situation, it is necessary to stop the outflow of dangerous substance as soon as possible to decrease hazard danger to health or to environmental damages.

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Picture 1: Share of Traffic Accidents of Transport of Dangerous Matters Connected with the Leakage of Dangerous Good in the Years 2004 – 2007 Source:[ 1 ]

The basic presumption for security ensuring by transportation of dangerous substances is the selection of acceptable vehicles and acceptable personnel. The vehicle-personnel are formed by driver and driver's assistant by some transportations, alternatively also by the person accompanying goods. Driver's assistant must be available on the transport unit by 1<sup>st</sup> class explosives transportation. The driver's assistant must be able to change the first driver (said in general, he is the second driver).

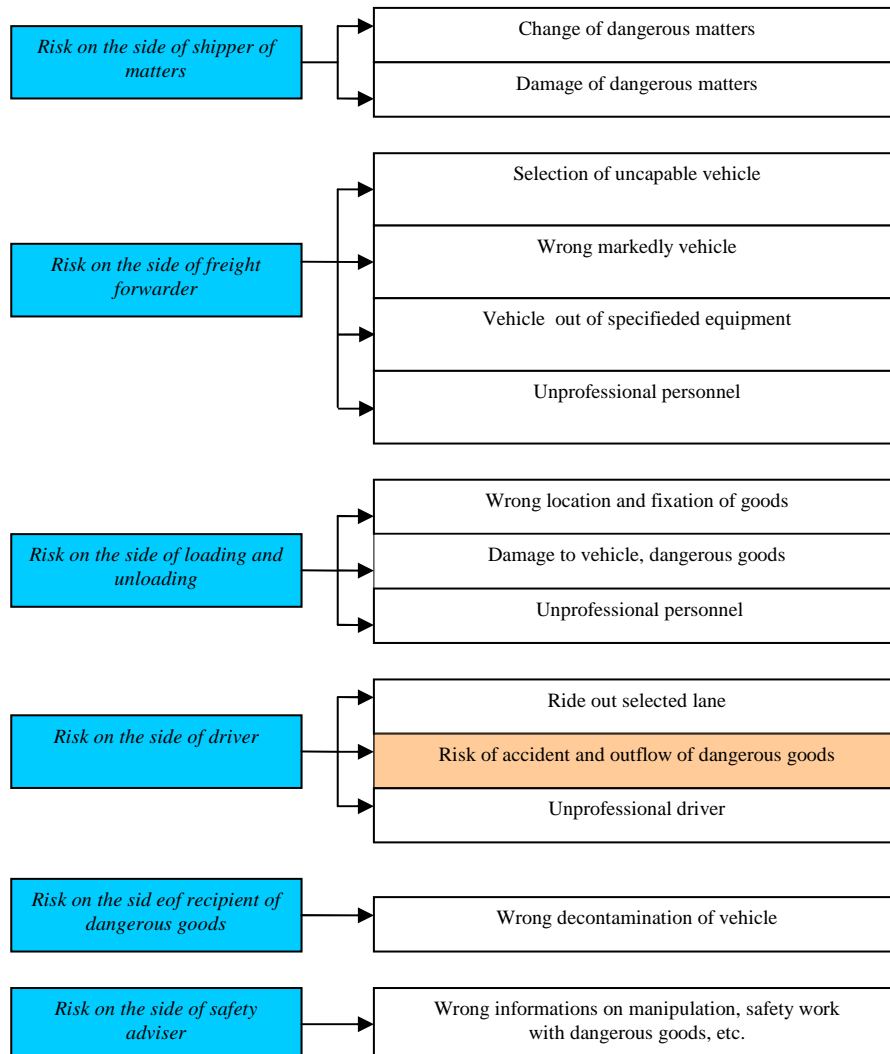
The driver must have the abilities and experiences of with truck transport driving. The drivers of tanker vehicles with inward volume over most 3 000 litres and since 1.1.1996 also the drivers of tanker vehicles with total weight > 3 500 kilograms in categories C and F named in Appendix 6 of the Road Transport Agreement (1968) are obligated to pass special teach-in and to have a certificate about of this graduation.[2]

Requirements to packing are processed for every class of dangerous substances and subjects. The segmentation of requirements is: universal requirements to packing, requirements to packing of single substances and subjects and conditions for collective packing. The applicable packages are divided in Agreement after kind, manufactured material and type. After it they are marked with code consisted from Arabic numeral labelling for kind of material and letter (by combination packing with two letters) describing used material and with next Arabic numeral labelling constructive type of packing. That labelling is prescribed by Agreements ADR, RID, IMDG-Code and DGR-IATA.[3]

The transaction of all manipulations are generally prescribed for all classes of dangerous substances and subjects, and specifically for each class. The regulations are concerned in process of loading, seating of load, places of loading operations, weight limitation, level of cistern refill, filling pressures, enclosure and ventilation.

### 3 Risk estimation of dangerous matters in road transport (Stanovení rizika při silniční přepravě nebezpečných věcí)

On the base of analysis has been found that the most frequented risks are able to occur by traffic accidents with possibility of leakage of dangerous matters (see Picture 2).



Picture 2: Risks of Dangerous Matters in Road Transport Source:[Author ]

### 3.1 General presumptions for establishing of critical places of dangerous articles transportation on Czech roads

It is necessary to examine accident's volume of cargo vehicles which carry dangerous articles. The examination is based on traffic accident's records in a given time period. It is necessary to have information about a place of a traffic accident, time of the accident origin, reasons of origin and about participants of the traffic accident.

### ***3.1.1 Place of the traffic accident origin***

A place of the traffic accident origin is the most important stand-point for assessment of critical places on the transport infrastructure. It is important to have information about the road, where accident has happened, for assessment. This information should be detailed for high-exact of partial results. That information includes road category, kilometre of road, but also the direction in which the accident has happened.

### ***3.1.2 Time of the traffic accident origin***

Another stand-point for the assessment of the critical places is time, which is important for assessment of the traffic accident's reason. Every day period has its specificity which influences on risks of the traffic accidents. It is possible to mentioned changes in traffic intensity during the day (the week), variable sight-rate in different day period, but also in different seasons. Its roll plays also weather conditions and technical conditions of roads. The places with frequent occurrence of traffic congestions influence places of traffic accidents origin and process of quest.

### ***3.1.3 Reason of the traffic accident origin***

It is necessary to know reasons of the traffic accident for critical sections problem solving. The reasons should be driver's failure, another reasons (dangerous articles, defects on the road, and so one). It enables to make the survey about the traffic accidents classification and utilizes reasons for probability calculation of generation of the traffic accidents.

### ***3.1.4 Participants of the traffic accidents***

A category and a technical condition of all vehicles, which participate on the accident, eventually information about another participate persons (pedestrians), are inherent information for the risks elimination during this special transportation.

The risk estimation by the transport of dangerous goods has been solved on the base of the multi-criterional analysis, especially by "Event Tree Analysis (ETA)" and "Fault Tree Analysis (FTA)" methods. Both methods have been employed by risk estimation in the most frequent risk parts of transport of dangerous goods – by traffic accident.

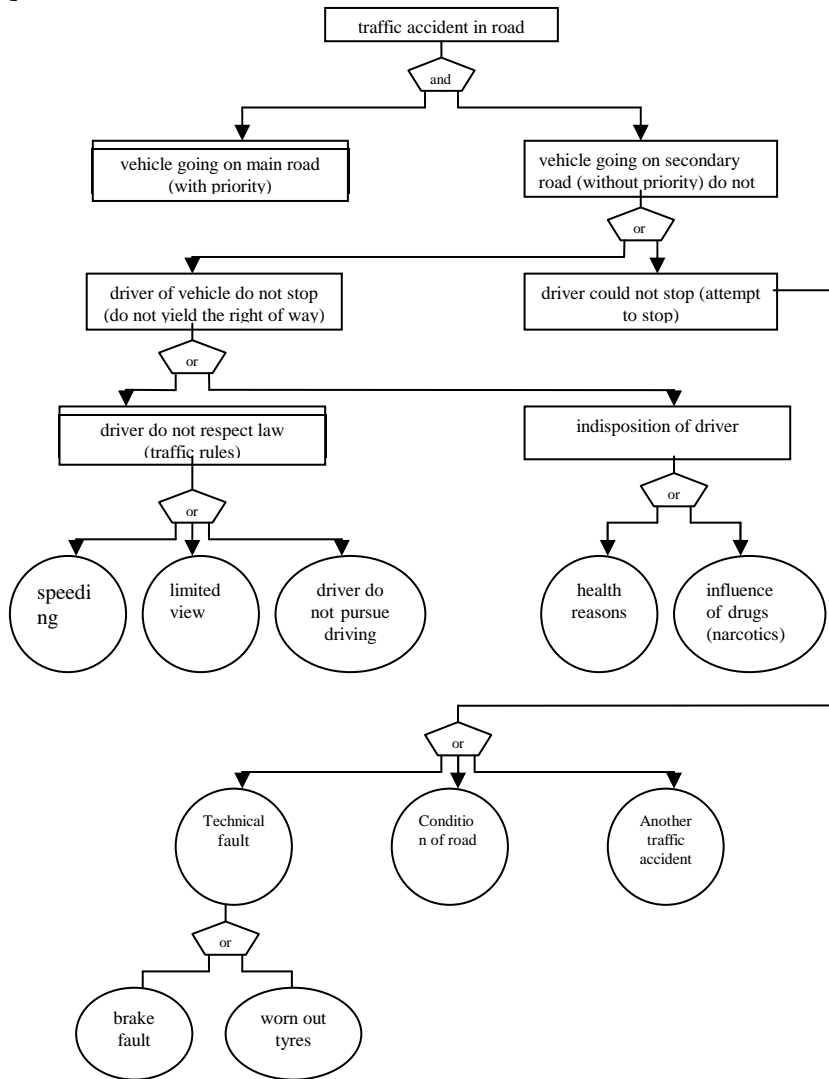
## ***3.2 Employing of the Event Tree Analysis (ETA)***

The "**Event Tree Analysis**" method is belonged to **inductive methods** analysing system from down to up, from causes to consequences. The sequence of events becomes unwound from initial event to various final stages of system. The possible accomplishments and faults of the process of the safety functions of the system are considered in the analysis. The ETA is based on **graphical projection in the form of event tree**.<sup>[4]</sup> Each sequence of clearly defined events followed-up initial event is characterized as a branch of tree (e.g. vehicle - technical condition, transport infrastructure and surround, human - driver, pedestrian and cyclist).

## ***3.3 Employing of the Fault Tree Analysis (FTA)***

The Fault Tree Analysis (FTA) is based on the creating of the tree of causes. The directions for creating of trees are based in the norm "ČSN – The Analysis of the Tree of Fault States."<sup>[5]</sup> **FTA is belonged to deductive methods. The all possible causes contributing to consequences of traffic accident are identified and analysed by the FTA method.** The process of the FTA is conducted from the

consequences and outgrowths of traffic accident to partially causes. The tree diagram is utilized for decomposing of causes into constituent levels. (Picture3) Particularity is that the conditions for setting in of the causes are also specified. The factor of risk is estimated by the probability calculation that the fault will appear.[4]



Picture 3: Fault Tree Analysis (FTA) – Traffic Accidents in Road Intersection

Source: [Author]

#### 4 Conclusion

During transport of dangerous matters not only in the Czech Republic, but also in the world, is devoted big attention, because this transport can evoke damage not only at the possession, but above all by health of people and by environment. With right technological methods can be these dangerous goods transported more quickly and with more safety. In the case of accident there is necessary to react in time and to render of assistance.

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