

TRANSPORT RISK IDENTIFICATION AND ASSESSMENT

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Resume

The transport process is characterized by transport operations and the relationships between them, the route, the time of transport and the type of product transported. One of these parameters is the degree of risk associated with a possible disruption of the transport process. Therefore, this article aims to present the possibility of calculating the degree of risk on the selected transport route. The risk level is calculated on based on the actual risk incidents on the transport route.

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1 Introduction

The transport and logistics industry provide one of the most important services of the modern globalized and interconnected world. Since the beginning of 2020, more and more countries around the world have closed their borders and restricted traffic and travel in order to prevent the outbreak of coronaviruses (COVID-19) pandemic, thus creating barriers to international trade and transport. The pandemic affects almost every dimension of economic activity and individuals around the world. Due to the outbreak of coronavirus, the supply chains are limited in the logistics and transport industries, although they are different in the air, freight and maritime sectors. Nevertheless, the risk incidents occur that negatively affect the transport processes.

1.1 Global cargo crime trends

According to new research, the insurance company has the largest cargo theft in the world in the field of freight transport, whether it is a criminal activity during the transport or in a parking lot. In the following Figure 1 one can see a comparison of the total criminal activity in transport for selected years in the EMEA region. Most crimes occurred in Germany, France and the United Kingdom.

If one looks at the type of criminal activity, shown in Figure 2, one can notice that the most common criminal activities are theft from vehicle, theft of vehicle, theft

of container or robbery. This is followed by theft from facility, fraudulent pick up, hijacking, etc.

There are different ways of parking on roads in Europe, in compliance with the Regulation 561/2006 or the AETR agreement (required rest of professional drivers), [2]. Some use regular public car parks, others park on the side of roads, while those more responsible rely on security car park services. The biggest problem is parking in unsecured parking lots. One can see in Figure 3 the number of attacks at unsecured parking places. Drivers use unsecured parking areas because there are few safe parking lots around the world. Their number in this period is 7500, which is absolutely insufficient with the growing number of road freight transport.

Risk identification

Identified risks along with their respective mitigation measures are:

- hijacking - the use of force (armed or unarmed), threat or intimidation to kidnap the driver in order to take the vehicle,
 - impact: loss of cargo, monetary loss, customer dissatisfaction, crew injury,
 - measures: insurance, safety parking spot, security equipment, training,
- robbery - the use of force (armed or unarmed), threat or intimidation in order to steal shipments/cargo while employees, guards or drivers are present and coerced to allow access (open doors), hand over goods, hand over vehicle,
 - impact: loss of cargo, monetary loss, customer

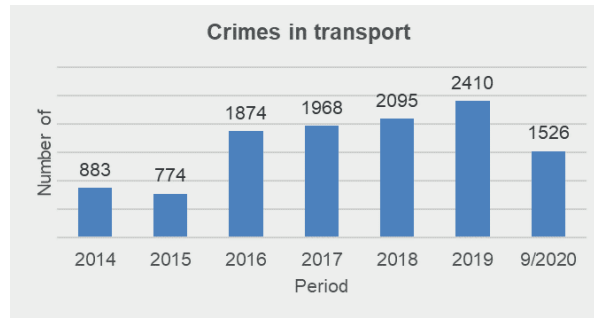


Figure 1 Number of crimes in transport in EMEA region [1]

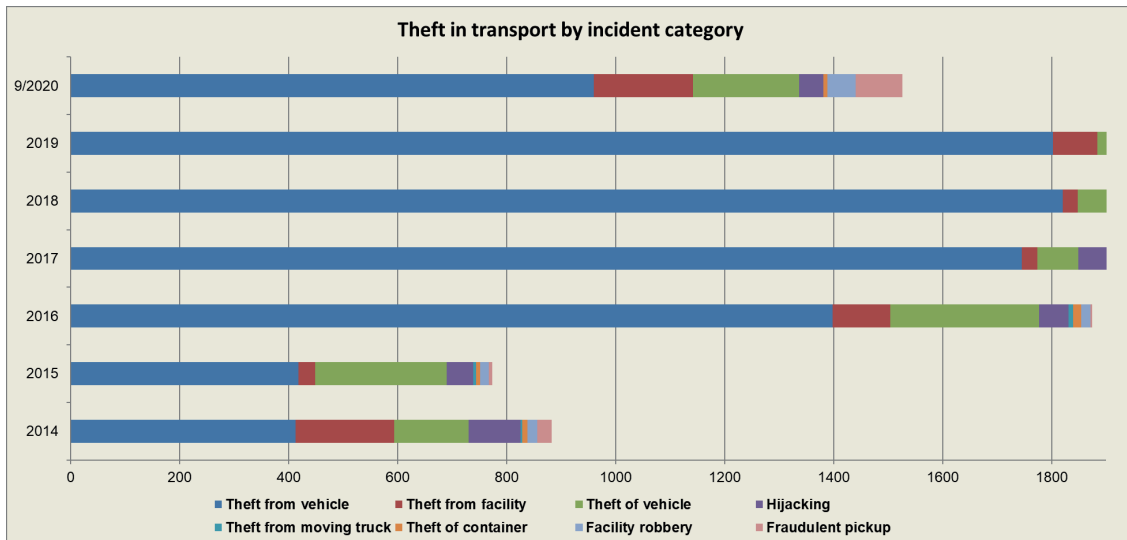


Figure 2 Theft in transport by incident category [1]

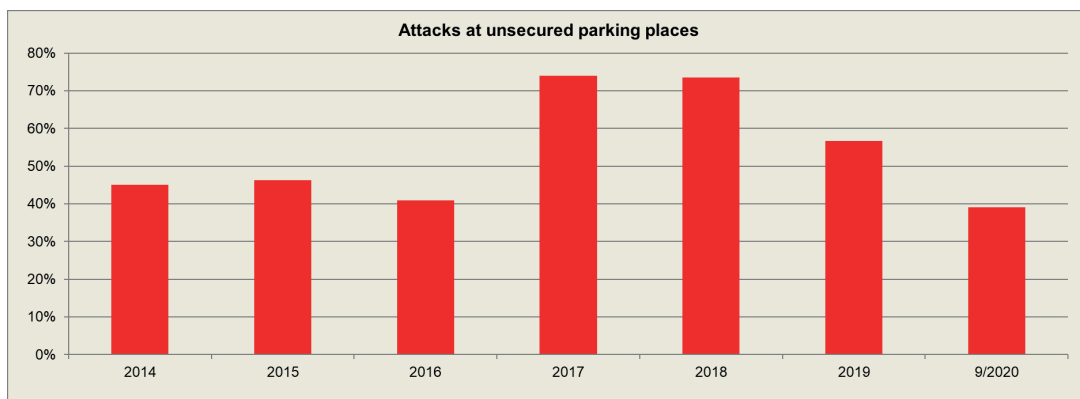


Figure 3 The number of attacks at unsecured parking places [3]

- dissatisfaction, crew injury,
 - measures: insurance, safety parking spot, security equipment, training,
- theft - general term for wrongful taking of property without the owner's willful consent,
 - impact: loss of cargo, monetary loss, customer dissatisfaction,
 - measures: insurance, training, safety parking spot, security equipment, trailer door monitoring,
- fraud - theft by deception; offense of deliberately deceiving another in order to damage them - usually, to obtain property or services from the victim unjustly,

- impact: loss of cargo, monetary loss, customer dissatisfaction,
- measures: insurance, training, verification of documents, verification of shipper [4-7].

1.2 Risk assessment matrix

The purpose of the risk assessment is to analyse and evaluate the identified risks to determine whether they need to be treated. Diagrams or matrices can be used to illustrate risks (See Table 1). This matrix is an example in which risks are assigned priority classes

Table 1 Risk assessment matrix [7]

likelihood / frequency	risk category			
	I catastrophic	II critical	III marginal	IV negligible
frequent	1	3	7	13
likely	2	5	9	16
occasional	4	6	11	18
remote	8	10	14	19
unlikely	12	15	17	20

risk index	risk acceptance category
1 - 5	not acceptable
6 - 9	not desirable
10 - 17	acceptable with extra control
18 - 20	acceptable with no extra control

Table 2 Matrix of losses and frequency [7]

losses / frequency	losses and violence			
	catastrophic loss > 100 001 €	critical 100000 € < loss < 25001 €	marginal 25000 € < loss < 1001 €	negligible loss < 1000 €
frequent > 4.75	1	3	7	13
likely 3.5 < li < 4.75	2	5	9	16
occasional 2.25 < li < 3.5	4	6	11	18
remote 1 < li < 2.25	8	10	14	19
unlikely < 1	12	15	17	20

created by a combination of their acceptability and consequences. Such tables must be adapted to the needs of a particular organization or risk assessment objective. This risk assessment matrix contains hazards, which are categorized relatively to their degree of criticality among

- Catastrophic
- Critical
- Marginal
- Negligible,

based on their consequences in the activity under investigation. Since the frequency of each potential occurrence is important factor, this assessment risk matrix can be used to codify the risk assignment, which in conjunction with the risk assessment table present the total picture of the threats that company faces, their consequences and likelihood of occurrence [7] (see Table 2).

The risk assessment matrix is characterized according to the colour scheme that best describes the desired security level for each risk situation.

Beyond the qualitative calculation of the likelihood of occurrence for a catastrophic event, there is also the capability for quantitative computation of such a figure, in the case that the valid statistical data are recorded. Furthermore, the use of modern specialized statistical methods and models can offer significant increase in reliability of the calculation of the risk frequency of risks, with a dramatic contribution in the overall reliability of the risk assessment under examination. It is obvious that the calculated risk frequency is a crucial factor. Combined

with the factor of Criticality, an organization can find out how urgent a certain risk is and then deal with it, according to the priority it assigns to that risk [8-10].

1.3 Risk assessment for transport route

For effective route planning and scheduling, it is necessary for the employees of the transport department to participate in the preparation of the distribution plan, or at least to know and understand it. The vehicle routing and planning process must meet the following objectives:

- maximizing the payload of a vehicle (by maximizing vehicle fill out and back) and maximizing vehicle utilization (by maximizing the number of loaded journeys per vehicle);
- minimizing distance (e.g., minimizing overlapping deliveries) and minimizing time (e.g., minimizing motionless time); and
- meeting the customer requirements in terms of costs, services and time and meeting the legal requirements in terms of vehicle capacity and driver hours [1, 11-13].

If the dispatcher wants to plan a safe transport for the driver, he must consider:

- date and place of loading,
- date and place of unloading,
- type of road infrastructure (highways, urban and

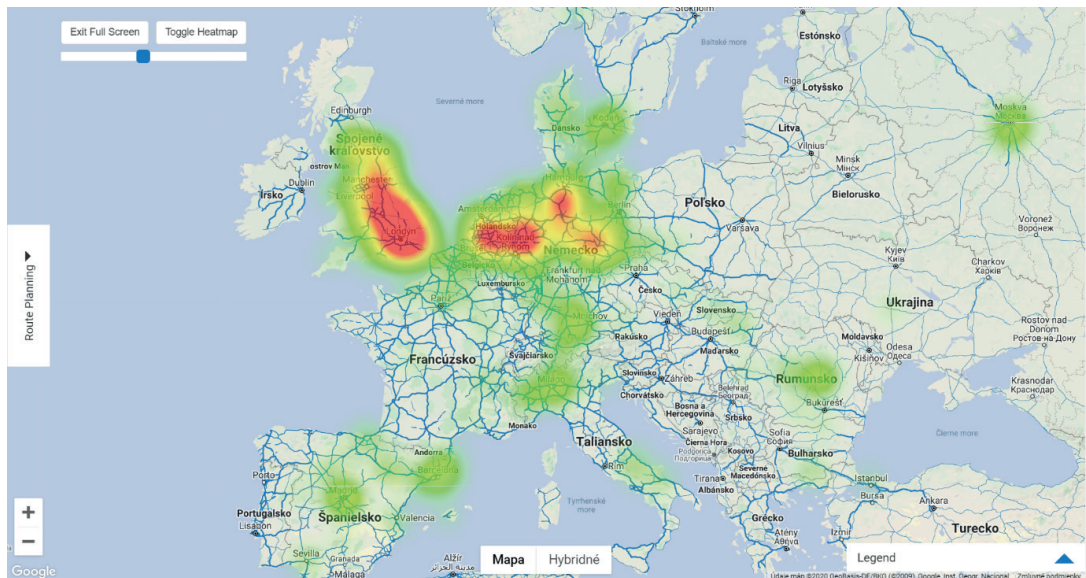


Figure 4 The intensity of cargo crimes in the Europe in February 2020 [15]



Figure 5 The type of crimes in World in 2020 [3]

- rural roads),
- secure parking available,
- driving time restriction,
- risk assessment.

The road infrastructure is important due to the different speed limits and capabilities in place. If it is possible, for the highly valued transportations highways are preferred.

As mentioned above, during the transport, the driver is exposed to several types of risks [7]:

- theft,
- robbery,
- hijacking,
- fraud, etc.

One needs to make a category table of risk:

Incident type:

- Category I - hijacking, robbery, fraud

- Category II - vehicle theft
- Category III - theft from vehicle
- Category IV - other theft (theft of container, theft from facility, ...)

Modus operandi:

- Category I - forced stop, violence
- Category II - deceptive stop
- Category III - intrusion
- Category IV - deception

Average monetary loss (€):

- Category I - Loss > 100 001 €
- Category II - 25 001 € < Loss < 100 000 €
- Category III - 1001 € < Loss < 25 000 €
- Category IV - Loss < 1 000 €

Likelihood Index:

This index is calculated based on the following formula:

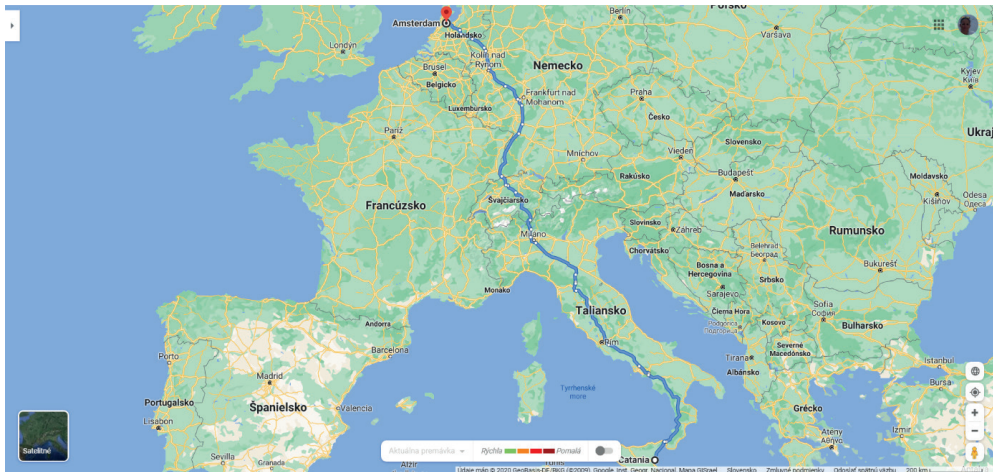


Figure 6 The first transport route from Catania to Amsterdam [3]

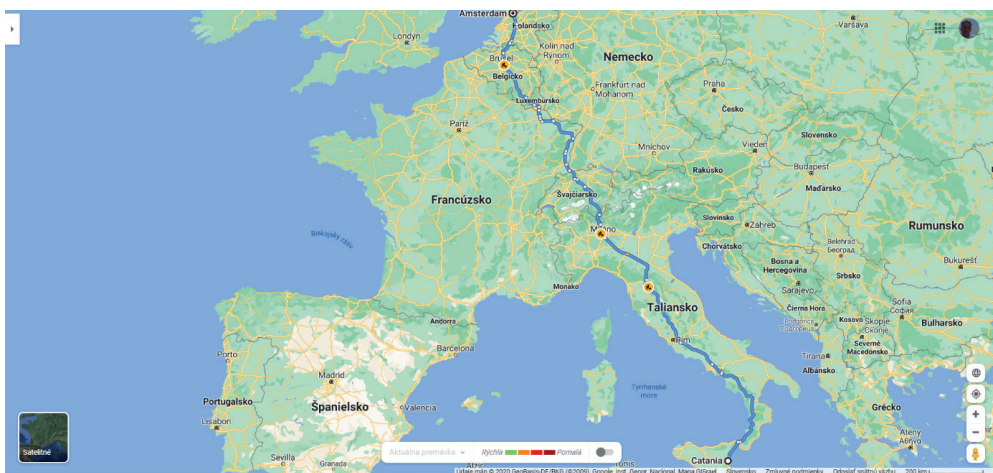


Figure 7 The second transport route from Catania to Amsterdam [3]

$$\text{likelihood index} = \frac{\text{index}/\text{years}}{\text{km}/100} = \frac{\text{index} * 100}{\text{km} * \text{years}}, \quad (1)$$

where:

km - the length of the route in km,

incidents - the number of incidents across the route,

years - the time period that includes the incidents [7].

1.4 Route planning

If the carrier wants to plan the transport with regard to safety, he must know the applications that will help him in this. One of them is the TAPA IIS database focused on the safe truck parking places. In addition to information about safety truck parking places, the IIS database also provide information about security incidents classified by several categories, including:

- burglary,
- fraud,
- hijacking,
- robbery,
- theft (theft from vehicle, theft from facility, theft of vehicle, truck theft) [1, 14].

Modus operandi:

- deception,
- deceptive stop,
- forced stop,
- fraud,
- internal,
- intrusion,
- pilferage,
- violent [9, 15].

In Figures 4 and 5 one can see the IIS heatmap tool, which shows the intensity and type of the cargo crimes in the UK and the Netherlands in the month of February 2020.

The following example shows how the risk of criminal activity could be reduced by planning a transport route [16]. Two routes from Catania to Amsterdam (see Figures 6 and 7) were chosen. The characteristics of the individual routes are given below.

The data needed for calculation were taken from the IIS Database provided by TAPA. All incidents are reported by the TAPA EMEA members only. For the public, data from the database are provided only for the last 90 days. The complete database is only for members who pay for membership every year. The

Table 3 Matrix of the first and second route information

	kms	countries	incidents	likelihood index	average loss (€)	risk index
route 1	2416	4	92	7.616	68 000	10
route 2	2445	6	54	4.744	156 000	8

$92 * 100 / 2416 * 0.5 = 7.616$

$58 * 100 / 2445 * 0.5 = 4.744$

number of accidents on selected routes is for the first half of 2020 (see Table 3).

2 Results and discussion

From the case study one can evaluate the following conclusions:

Route 1:

Risk index: 10

Through:

- Italy, Switzerland, Germany, Netherland

Countries crossed: 4

Distance: 2416 km

Estimated total duration: 66 hours

Short breaks: 45 min - 4

Long breaks: > 45 min - 3

Number of incident: 92

Likelihood index: 7.616

According to the likelihood index, this risk is classified as Frequent.

Assessment Methodology:

Average money loss: 68 000 € from incident reporting money loss.

Category II

Risk acceptance category: **Not acceptable**

Incident type: 64% of incidents reporting Incidents type are recorded as Theft from vehicle

Category III

Risk Acceptable category: **Not desirable**

Modus operandi: 68% of incidents reporting a modus operandi are recorded as Deception.

Category IV

Risk Acceptable category: **Acceptable with extra control**

According to the above, route 1 is ranked at 3 for money loss, 7 for incident type and 13 for modus operandi.

Route 2:

Risk index: 8

Through:

- Italy, Switzerland, France, Luxemburg, Belgium, Netherland

Countries crossed: 6

Distance: 2445 km

Estimated total duration: 67.75 hours

Short breaks: 45 min - 5

Long breaks: > 45 min - 3

Number of incident: 54

Likelihood index: 4.744

According to likelihood index, this risk is classified as

Likely.

Assessment Methodology:

Average money loss: 156 000 € from incident reporting money loss.

Category I

Risk acceptance category: **Not acceptable**

Incident type: 49% of incidents reporting Incidents type are recorded as Theft from vehicle

Category III

Risk Acceptable category: **Not desirable**

Modus operandi: 53% of incidents reporting a modus operandi are recorded as Intrusion.

Category III

Risk Acceptable category: **Not desirable**

According to the above, route 2 is ranked at 2 for money loss, and 9 for incident type and modus operandi.

3 Conclusions

After comparing the two routes, one could come to the following conclusions:

Route 1 is categorized as Not acceptable (3), Not desirable (7) and Acceptable with extra control (13). Route 2 is categorized as Not acceptable (2), Not desirable (9), Not desirable (9).

Route 1 is shorter and scored the same as route II in two categories - Average money loss and Incident type, but in Modus operandi category has an acceptable with extra control. Route 2 is longer and lead across six countries, so probability of the delay at the border is greater.

The security route risk assessment should always be a part of the route planning activity. The road risk assessment applies the standard risk assessment approach to many hazards associated with driving for work, including journey length, allowing enough time for the journey, arrangements to take a break, driving posture, route choice and thinking of alternatives to driving. The risk assessment is beneficial for carriers and their customers and can lead to prevention of possible losses from the risk accidents.

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