1 Introduction

In railway passenger transport is notion of risk in many cases perceived as accidents with a tragic character. The current time brings the view on risks in railway passenger transport in the wider sense. In many cases these risks are resulting from the constantly growing demands of customers. Risks in railway passenger transport cannot be understood only as accidents, but also as risks which in a competitive environment represent an imaginary difference when choosing mode of transport or carrier from the view of passenger.

In this paper we present risks assessment in the railway passenger transport (RPT), which arise in relation to the customer and partial results of research conducted at the Department of Railway Transport. The research was focused on the segmentation of risks in the RPT and understanding of the risks from the perspective of the passenger.

2 Risks segmentation in railway passenger transport in relation to the customers

Notion of risk can be defined as the fact that there is a possibility of a security breach. It is a quantitative and qualitative expression of threat, the degree or level of the threat. [4]

Risk is a combination of uncertainty and undesirable consequences. If we are able to quantify uncertainty and undesirable consequence, the risk can be calculated from the relationship: [1]

\[
Risk = uncertain \times undesirable \text{ consequence}
\]  

Within the railway passenger transport the passenger is exposed to large amounts of potential risks. Each passenger sees the risk subjectively, what constitutes a risk to one passenger does not mean that they must present a risk for the second passenger [3, 5]. In RPT we can divide risks from the view of influence to the customer on two types: risk which arise during the transportation process and risks which arise at railway station. The Figure 2 shows the basic division of risk in relation to the customer in RPT.
2.1 Risks during transportation / on the track

Risks which have impact on passengers during transportation we can divide into:

- The risk caused by human factor - intentional or unintentional action of man can be designated as a factor that raises risk (see Table 1).
- The risk arising from the nature of railway vehicles - this area is primarily follows mainly from the level of reliability, security, and the modernity and comfortability of driving (motive power unit) and powered vehicles (see Table 1).

**Table 1 Risks segmentation**

<table>
<thead>
<tr>
<th>The risk caused by human factor</th>
<th>The risk arising from the nature of railway vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>From internal environment of NPT</td>
<td>From external environment of NPT</td>
</tr>
<tr>
<td>employees</td>
<td>vandalism</td>
</tr>
</tbody>
</table>

- The risk arising from the transport infrastructure - an important factor in the area of risk of railway tracks is technical and qualitative condition of railway tracks to a greater extent on regional level. Unsatisfactory technical condition of the railway tracks resulting from wear material constitutes a risk for the customer, which is from his view difficult to assess due to the complexity and difficulty of the design elements of railway tracks.
- The risk of an economic nature - represent risk which came out from business activity of individual business entities. These risks occur in such an extent as the State interferes in the transport policy of railway undertakings as are: low frequency of train connections, insufficient number of train connections.
2.2 Risks at railway station

The risks faced by passengers in railway stations have a similar distribution as risks during transportation. Possible risks of acting on the passenger railway station are divided into:

- The risk caused by human factor - These risks can be divided into those that are caused by internal human factors (employees) and external human factors. The risks from the external environment associated with crime, vandalism, unadaptable citizens or terrorism and its result is an unsettling feeling of safety of passenger safety and in many cases also the public.

- The risk arising from the condition and equipment of the railway stations - railway station and its surroundings evokes in the eyes of the traveling public a persistent problem from the view of arising risks. The most common factors that determine risks formation can be include the representativeness of stations and the availability of the platforms. The term unrepresentative railway stations represent: old paint in the stations, devastated benches, unkempt toilet, or unadaptable citizens who by their presence plague customers stay at the station and repel potential customers.

- The risk of an economic nature - these risks arise in connection with railway stations and its environment. Include human factor or technical equipment of railway stations and others.

3 Evaluation of conducted research

The aim of conducted research was to find out which kinds of risks act on the passengers in railway transport. The research was carried out in 2015 and was attended by 400 respondents.

For assess the potential risks in passenger transport was used character multi-criteria method, which belongs to the subjective method. This method used the weight of importance with point scale from 1 to 4. Number 1 means that passenger considered a potential risk for a fairly important or the most important and number 4 means that passenger considered the potential risk as unimportant.

3.1 The risk assessment during transportation

In the introductory part of the research respondents were asked the following questions: „Are the following factors potential risk for you?“. Passengers had to choose factors that pose potential risks in railway passenger transport for them.

By marking of answer yes or no, passengers expressed their subjective opinion and marked the factor which acts as a risk for them. The following factors posing a
potential risk during transportation respondents identified in greater numbers: 93% delay of trains, lack of awareness 81%, and convenience during traveling 74%. Figure 2 contains complete percentage representation of the potential risks during transportation.

**Fig. 2 Factors which posing a potential risks during transportation**

Source: [2, 4]

Then passengers had to express the weight of importance of individual factor, which marked in the first part as a potential risk. Respondents most often labeled the weight of importance 1 on the following factors: lack of awareness 64% and 54% delays of train. The lowest weight of importance the respondents assign to the factors: terrorism 35 % and extreme weather 14 %. Results are shown in the Figure 3.
3.2 The risk assessment during transportation

For evaluate the risks at the railway station was posed to passengers the same question as in the evaluation of risks during transportation: „Are the following factors potential risk for you?“. The evaluation was carried out similarly as in Chapter 3.1.

The following factors posing a potential risk in railway station respondents identified in greater numbers: lack of awareness 84%, unrepresentative areas of railway stations 78%, lack of underpasses and overpasses 73%. Results are shown in Figure 4.

Source: [2, 4]
Respondents most often labeled the weight of importance 1 on the following factors: lack of awareness 65% and unrepresentative areas of railway stations 78%. The lowest weight of importance the respondents assign to the factors: terrorism 22% and failure of iKVC 16%. Results are shown in the Figure 5.
3.3 Passenger’s experiences with solving of risks

Passengers have different experiences with solving of risks from the side of carriers or infrastructure manager. These experiences can arise during the transportation or at the railway station and can represent the potential risks.

53% from the 400 respondents surveyed said that they have a negative experience with solving of the risks. Figure 6 shows the proportion of positive and negative experiences with solving of risks.

**Fig. 6 Experiences with solving of the risks**

Source: [2]
In the following table 2 are shown specific reasons of positive or negative experiences.

**Table 2 Experiences with solving of risks situations**

<table>
<thead>
<tr>
<th>Positives</th>
<th>Negatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williness of the staff in coffers during the provision of information about the transportation options</td>
<td>Failure to provide information about the reasons of the train delay</td>
</tr>
<tr>
<td></td>
<td>Inadequate communication of train guide during the questions about train delay</td>
</tr>
<tr>
<td></td>
<td>The long wait for replacement locomotive during technical defect of the locomotive</td>
</tr>
<tr>
<td></td>
<td>Confusing information about free transportation</td>
</tr>
<tr>
<td></td>
<td>Unwillingness of train guide with assistance to loading stroller</td>
</tr>
<tr>
<td></td>
<td>Harassment of inadaptive inhabitants in station areas</td>
</tr>
</tbody>
</table>

Source: [2]

4 Methodic for risks assessment

For monitoring and assessing risks in the railway passenger transport can be used several methodologies. One of these methods is Method of analysis of the frequency and importance of a risk.

The method lies in determining the risk value from the questionnaire survey, or from the expert estimate and subsequent classifying of the risks to the table in ascending or descending order, depending on the frequency and relevance of risk. Table 3 shows the frequency of occurrence of specific risks and relevance of risks (weight) from highest to lowest.

**Table 3 Frequency and relevance of risks**

<table>
<thead>
<tr>
<th>High</th>
<th>Frequency of risk appearance</th>
<th>Relevance of risk / weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>delay of trains</td>
<td>technical difficulties of rolling stock</td>
</tr>
<tr>
<td></td>
<td>technical difficulties of rolling stock</td>
<td>delay of trains</td>
</tr>
<tr>
<td></td>
<td>lack of awareness</td>
<td>lack of awareness</td>
</tr>
<tr>
<td></td>
<td>barrier-free access to the railway station</td>
<td>feeling of safety</td>
</tr>
<tr>
<td></td>
<td>unadaptable citizens</td>
<td>unadaptable citizens</td>
</tr>
<tr>
<td></td>
<td>feeling of safety</td>
<td>barrier-free access to the railway station</td>
</tr>
</tbody>
</table>

Source: [2]

This evaluation can also be displayed according to Figure 7. On the x-axis are shown risks by relevance and on the y-axis are shown the risks according to frequency of appearance. In the Figure 1 are for simplification shown only four risks, which are
marked A to D. According to Figure 1 is possible to proceed in determining the measures for reduce the risk priority gradually from the risk A- highest priority, to D - the lowest priority.

Fig. 7 *Graph of frequency and relevance of risk*

![Diagram of frequency and relevance of risk](source)

Displaying through the picture serves for simple representation and determination priority of risk. The analysis of frequency and relevance of risk is mainly focused on sequences of solutions of priority of individual risk.

5 **Results and conclusions**

In the literature there are various definitions of the term risk. In condition of railway passenger transport we can speak about so-called transport risk which is represented as probability of creation technogenic or natural phenomena which are accompanied by rise, formation and action of risks. Then there occurs to the social, economic, environmental and other damage, or harm to human health (ie outcomes) in relation to the implementation of transport.

In the carried out research, we focused on assessment of transport risks from the passenger view. In the paper were defined two areas of risks: during transportation or at railway station. Passengers in the both areas marked as the major risk the factor - lack of awareness, which mainly related to insufficient system for the transmission of information (respectively handover only partial information) between the elements of...
the transport chain. Further risks from the perspective of passengers were delay of trains and unrepresentative appearance of the station building.

For individual risk areas that were defined in this paper, it is necessary to lay down practical measures that focus on prevention, technical adjustments and implementation of new technologies to the transport operation. By setting of practical preventive measures is possible to reduce risks, increase quality of provided services, ensuring greater safety of railway transport and ultimately reduce the cost of carrying out corrective measures.

Contribution is processed in terms of solving grant project KEGA 026ŽU-4/2015 “Innovative approaches in system of teaching management in the study program Railway transport with a focus on application the dynamic quality models in the railway transport” which is being solved at the Department of Railway Transport, University of Žilina.

References


[2] KEGA 026ŽU-4/2015 “Innovative approaches in system of teaching management in the study program Railway transport with a focus on application the dynamic quality models in the railway transport”


Resume

This paper deals with defining risks in the railway passenger transport which arise in relation to the customer. The paper theoretically describes the different risks arise in railway passenger transport. Theoretical analysis of types of risk is linked to the results of research that evaluates the customers’ view to the defined risks.

Key words

Risks assessment, customers, railway transport

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