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Sharing of best practices in provision of passenger information in stations and hubs

**Hungarian experience on provision of passenger information
in stations and hubs**

Submitted by Hungary



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Table of contents

1	Introduction.....	3
2	Authority authorization procedures.....	3
3	Some thoughts on railway projects.....	4
3.1	Projects from a technical point of view	4
3.2	Projects from a legal point of view	5
3.3	Projects from a financial point of view	5
4	Some thoughts on information.....	5
4.1	Travel Information	6
4.2	Information about commands	7
4.3	Information concerning to restrictions	8
5	Rights and obligations of persons connected with the railway company.....	8
5.1	Contract affecting passengers	8
5.1.1	Tickets.....	9
5.1.2	Ticket systems.....	10
5.2	Contract affecting employees	11
6	Functional theory approach.....	12
6.1	Examples of the functionality of individual components	12
6.1.1	Functions of the carbody.....	13
6.1.2	Functions of windows.....	13
6.2	Summary of function provision	14
7	Case studies.....	15
7.1	Railway systems	15
7.2	Underground systems	15
7.3	Ropeway systems	16
7.3.1	Sátoraljaújhely.....	17

1 Introduction

Authorisation procedures for railway infrastructure and railway rolling stock belongs to the scope of the Railway Authority Department of the Ministry of Construction and Transport (hereinafter: NSA HU) in Hungary. Since Hungary is one of the small countries in terms of population and territory, the authorisation procedures for special equipment must be carried out based on one of the laws applicable to general equipment. This range includes local and intercity public transport vehicles and trackside equipments, non-railway equipments, including ropeways. In several countries, the size of the country and the number of devices justify the creation of a separate unit, but Hungary is not one of these countries, but when authorising such devices, the given organization must have the appropriate knowledge and experience to carry out the procedures.

2 Authority authorization procedures

The official authorisation procedures are based on specific procedures, which are in line with European procedures. The task of NSA HU is as follows:

- Excluding possible accidents and reducing the probability of an accident to practically zero.
- If an accident has occurred, the exact causes of the accident are identified and additional measures are introduced to avoid accidents.

The official authorisation procedures cover the following in main lines:

- Local and intercity junction transport vehicles, special vehicles
- Stationary mechanical equipment
- Passenger traffic and operational areas of tunnels
- Ropeways and their equipment.

In terms of the tasks mentioned above, NSA HU must also take into account that the quality and quantity of information provided at individual stations and hubs does not cause confusion among passengers, a bad announcement can even lead to a panic.

3 Some thoughts on railway projects

The characteristic of railway projects is that they are prepared for the long term, with the development of technologies, more and more systems have to be coordinated, and therefore there will be an increasing demand for systems that have been operating independently until now to be effectively connected on several lines. The legal foundations of cooperation must be established as well. In addition to technical development, more and more international level contracts must be created, which cover more and more sub-systems within the railway transport sector, but the establishment of connections between the various modes of transport will become more and more important. In several cases, several years of work may be necessary to establish the legal background of a technical development, but it may also happen that the introduction of an international agreement is not yet possible due to technical conditions. Technical development is not possible without securing the financial resources for the above mentioned activities, but financial resources can come from the already operating activities. The current trends in the development of technology require ever closer connection of systems, and as a result, closer and closer cooperation will be expected from all areas in the future. Technology is currently developing step by step in such a way that a small advance in one area enables the development of another area, so we are facing a development process where everything is built step by step and not a single step can be missed, this is not only understood in terms of technology, but also to the level of the Member States. The failure of a Member State to take a given small step in development can even mean an irreparable disadvantage for that Member State. That is why the development of the railway can only be imagined with the close cooperation of the states, which does not mean new questions in air, road and water transport, it requires the cooperation of many specialists working in different fields in railway transport.

3.1 Projects from a technical point of view

Several European projects that are currently running through national borders, the developments achieved are the result of many years of work in international groups. The installation of ETCS opens up new horizons in railway transport, however, further development of the ETCS version is difficult to imagine without the development of the

digital automatic coupling. In general, if we want to introduce a railway development in 10 years, we should have taken the initial steps yesterday.

3.2 Projects from a legal point of view

The task of international contracts is to regulate the legal environment for the exchange of railway products between countries. Regulated conditions reduce the risk of rail-related operations. The reduced risk may mean lower loan interest rates, which means that the purchase of the railway product may involve lower costs. The above developments entail the updating of publications supervised by several organizations, in many cases it can take years to implement a modification, if publications of other organizations also have to be harmonized, then we are really talking about lengthy and laborious work.

3.3 Projects from a financial point of view

The implementation of the above activities is not possible without securing financial resources. Train control systems, railway tracks, railway vehicles, systems related to information management have a completely different life cycle, this includes other maintenance systems, and these must be operated in a completely different financial structure from a financial point of view. In general, if the risk in a system is lower, lower costs can be expected.

4 Some thoughts on information

INFORMATION is at the highlight of the present session. For the passengers, some information is necessary to conduct the trip, which must be published in such a way that this information is clear to everyone. The information can come via a voice announcement, the visual information can be static or dynamic. If possible, the information should be standardized in such a way that the information provided is clear even to passengers who do not speak the local language. With the development of technology, the transmission and reception of information can take place on an increasingly wide spectrum, however, more sophisticated devices are required to transmit and receive more complex information. We will see below that at a complex railway station - especially those that are directly connected to other modes of transport (e.g. an airport) - special care must be taken to ensure that passengers with the most

basic or the most sophisticated reception skills are required to complete the journey access information. It should also be borne in mind that due to system failure it is not possible to transfer the highest level of information, therefore only basic level of information is possible to exchange. Systems performing more and more functions have an increasing probability of failure, and the failure of some systems can lead to the failure of other related systems. Information is transferred, received, and its content is structured according to strictly defined conditions, below we will see how many conditions must be taken into account in the case of an exchange of information during the safe execution of the trip. Don't forget that the information given to the passengers can also be a command to the staff at the station and hub, and the information given to a staff can also have the content of a command. In the cases listed below, the devices installed to transmit information can even give commands to the passengers (e.g., due to a fire, the object must be left immediately), so it is difficult to draw the line between information and commands. Some of the information may contain a restriction, the subject of the restriction may vary from country to country.

4.1 Travel Information

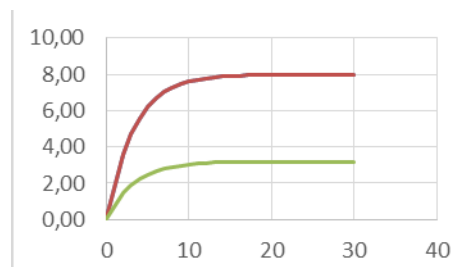
It is important to note that the smooth execution of the trip must be planned in advance, all transport companies use the word "travel planner" on their website. The planning support programs value the existence of certain knowledge as essential, if some information is missing, the traveler must take action to obtain it. When writing the design program, it must be taken into account that the level of geographical and local knowledge of the passengers may differ significantly. The destination station must be equipped with a device that provides a sufficient amount of information so that the passenger reaches his destination safely and does not get on the wrong train at the railway station of a multi-million city. It is a significant aspect that with the onset of darkness, the ability to find your way around varies significantly from person to person, which can have a serious impact on the feeling of safety. The passenger's fatigue can be an aggravating factor for the former two parameters, in the case of overseas travel, it is not uncommon for continuous attention to exceed 24 hours.

4.2 Information about commands

The concept of an commands plays a prominent role primarily for railway employees, since the signal image appearing on railway signals is a command. The transfer of various weather parameters is just information, but if this obliges the train driver to reduce the speed of the train, then this is already a command. If an emergency situation develops at a station or hub, the passengers will already receive commands to evacuate, the refusal of which may already fall within the scope of criminal liability. Each station has different parameters, in case of saturation or emptying, the number of passengers staying at the station or hub at a given time can differ significantly. In terms of modeling, the behavior of the passengers is best reflected by the behavior of the air in the brake cylinder in terms of saturation and emptying. Regarding the brake cylinder, we have to consider the following:

in the case of filling, the pressure increase can be characterized by the following formula:

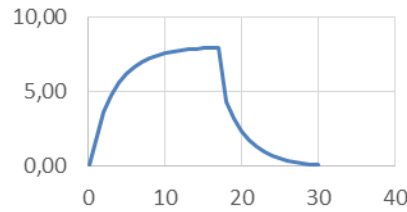
$p(t) = p_0 * \left(\frac{e - e^{-\frac{(T-t)}{T}}}{e} \right)$, where T is time constant, t is the instant, p_0 a maximal pressure in the cylinder.



1st diagram: increasement of pressure

In the case of releasing, the pressure reduction can be characterized by the following formula:

$p(t) = p_0 * \left(\frac{e^{-\frac{(T-t)}{T}}}{e} \right)$, where T is time constant, t is the instant, p_0 a maximal pressure in the cylinder.



2nd diagram: increasement and release of pressure

The above mentioned constants can change in case of different stations and hubs, the 1st diagram can be the saturation of a train or hall, the second the saturation or emptying of a station in the default case. The pressure can be considered proportional to the number of passengers.

4.3 Information concerning to restrictions

Pursuant to the above, railway companies can introduce various prohibitions in terms of conditions, but this must be made known to the passengers using various levels of information tools. In individual countries, railway companies can introduce various prohibitions, so in Hungary smoking is prohibited even in open bus stops, in Poland the consumption of alcohol in stations and trains will result in a police report.

5 Rights and obligations of persons connected with the railway company

Every person who comes into contact with a railway company as a passenger or employee must be aware of their rights and obligations. Either electronic systems must ensure that persons with a contractual relationship with the railway company are admitted to a given area, or access to a given area is restricted, if the systems do not allow this, then clear static information boards must be displayed. (In Hungary, it is not mandatory to post the words "EXIT" on exit signs.) Abbreviated service instructions for employees of the railway company and travel conditions for passengers must be posted. Based on Hungarian experience, after the legal settlement of the installed camera systems, the number of inappropriate actions on vehicles decreased significantly, the borderline was very sharp and conspicuous.

5.1 Contract affecting passengers

Every person who enters the territory of a railway transport company and uses the service provided by the company automatically accepts the terms and conditions set by the company what social status he holds. Unfortunately, the issue of illiterate

passengers also needs to be addressed, because illiteracy raises serious questions in several countries, and their care in the event of an accident must also be resolved. The conclusion of the contract is necessary for the following reasons:

- acceptance of general travel conditions;
- acceptance of special travel conditions;
- the travel contract includes insurance, which is important in unusual situations;
- treatment of illiterate passenger.

If the travel conditions do not fully cover the general rules of conduct, then without exception, the applicable laws of the respective state must be applied. If during the journey it is not possible to transport persons with reduced mobility or sports equipment, the railway company may introduce restrictions on this by offering an alternative. In summary, if justified, the railway company can limit the rights of the passengers to the following, or apply additional obligations:

- alcohol or drug consumption (in some countries, drinking on the railway platform is prohibited).
- inadequate state of health (e.g. in the case of a ropeway, the operating staff may exclude a person believed to be intoxicated from driving).
- in the event of special circumstances, limiting the performance of activities that can be carried out without limitation under normal circumstances.

The ticket issued by the railway company may contain information regarding means of transport and geographical validity. In several cases, the passenger unknowingly entered a zone for which his ticket was no longer valid. If the passenger is traveling on a network where gates restrict entry and exit, the passenger who inadvertently enters the wrong zone may end up in an unpleasant situation. The transfer of information on validity zones is still questionable, the quantity and quality of questions may differ from region to region.

5.1.1 Tickets

The ticket redeemed by the passenger is an expression of the contract concluded with the railway company. Modern railway stations no longer serve not only the purposes of transport, but also shopping, service and entertainment centers, however, the

passenger who changes a ticket wants to consider the railway station's travel-related functions. Tickets - especially when sent electronically to a smart phone - can provide additional information, even in real time, but it must be taken into account that in the event of a system failure, the tickets must also provide the passenger with basic information:

- Travel route
- Ticket price
- Ticket validity period
- Ticket validity area.

5.1.2 Ticket systems

In addition to international tickets, each country has developed its own ticket system, several regions of several countries have independent ticket systems, and in more than one case, some related regions of several neighboring countries have developed independent ticket systems. Considering the current conditions, the railway ticket system is almost opaque, only the experienced traveler can navigate through this multitude. In more than one case, the experienced traveler can get information about tickets that even the local people selling tickets are not aware of the options available. Based on experience, it is better for the traveler to make sure of the travel options well in advance, the local ticket machines often provide information of varying quality, the small screens of smart phones represent a very limited option in this regard. Ticket systems include various ticket management systems. In the eyes of the authorities, the most important thing is that the systems supporting the sale of ticket systems fulfill the following most important functions:

- be compatible with additional systems
- the purchase of tickets should be done in complete safety by observing the rules for data management, especially considering that the related bank transaction is an event with legal effect.
- the ticket purchase should be a clear correspondence from the point of view of the passenger and the train in question.

Taking the above into account, offers must be made to the passengers so that as many purchases as possible should lead the potential passengers to pass-type offers. This is also an important safety aspect, because the passenger rushing to the train does not have to spoil his comfort even by buying a ticket.

5.1.2.1 Short-term tickets

Tickets are usually valid for one trip or round trip. Buying these tickets is the biggest burden.

5.1.2.2 Medium-term, regional tickets

Offers for several days. Such was the Budapest-Vienna excursion ticket, which e.g. it also included local transport.

5.1.2.3 Interrail

Interrail is currently the best working pass system, but it is only accepted in a limited number of countries, which can cause inconvenience during travel.

5.1.2.4 Proposal: Europe pass

In general, it can be said that the passengers uses rail transport to reach their destination. If trips are not made for tourist purposes, then one or two trips per day will be made, of course, multiple transfers are not considered separate trips. If a tourist trip is made by train, the passengers wants to spend as little time as possible on the train, spend as much time as possible for tourist purposes, and also want to get back to their accommodation not too late on the same day. With these conditions, it is likely to visit 2-3 locations per day, visiting more will probably take place at the expense of the next day's activities. A pass system that is accepted by all railways in Europe and valid for all local means of transport would definitely be necessary. The fee categories have already been determined, and can presumably be transferred when a new pass system is created. The goal is to attract as many passengers as possible to railway stations, where they can carry out other entertainment and shopping activities while on the road, which can also generate income for the railway companies.

5.2 Contract affecting employees

Answering the above questions is also necessary if a legal person contacts the railway company on the basis of work. In this case, the railway company can impose special

conditions in addition to the usual conditions, the observance of which is mandatory, failure to do so may even lead to the initiation of criminal proceedings. In summary, if justified, the railway company can limit the employee's rights to the following, or apply additional obligations:

- alcohol or drug consumption (prohibited in the first place on duty)
- restrictions regarding the health condition required for work (e.g. high blood pressure cannot work in the vicinity of a railway track).
- in the case of special circumstances, carrying out activities that can be carried out without limitation under normal conditions (e.g. regulations for emergency rescue).

6 Functional theory approach

Several modern branches of science deal with the functional approach of systems, which means that the passengers expects functions from the elements of transport, if railway companies want to achieve the satisfaction of the travellers, these expectations must be met with the appropriate functions of the system. Thus, it may turn out that the punctuality of the train is much more important to the passenger than the travel time, because he wants to reach his connection. In order to check the most important parameters of the means of transport, various methods were used, such as lifetime cost analysis, failure analysis, and value analysis. Basic functions can be the following:

- Safety
- Accuracy
- Speed
- Minimizing costs

6.1 Examples of the functionality of individual components

During the function analysis, the functions performed by the smallest parts must also be analyzed, it may happen that the same part can perform several independent functions. We can see below that there are parts that perform their better functions at the cost of reducing the function of the other part, so serious compromises have to be made when designing a vehicle, but none of the parts will be able to perform their

functions fully. In the following, we will study the relationship between the cabinet frame and window, the windows of the vehicles are fixed in the carbody.

6.1.1 Functions of the carbody

The task of the carbody is to absorb the loads on the vehicle, which can be dynamic and static forces. If we consider that the chassis of a locomotive must be able to absorb a force of 2,500 kN from a collision without distortion, then we can see how much force we are talking about. From this point on, we can understand that the carbody can perform its task best if a single release (e.g. window) is not installed. This would mean that the passengers would not be able to get on the vehicle either, if we even allow a door opening, they would not be able to see out of the vehicle. According to the above, it is necessary perform the following functions without claiming to be complete:

- It should be manufactured as cheaply as possible and easy to assemble.
- Protect from environmental influences, such as rain, snow, warm noise.
- Enable the safe installation of various furnishings.
- Withstand the pressure waves from the passing of an oncoming train.
- In connection with the example, the fixing of the windows should be solved.

6.1.2 Functions of windows

The primary function of windows is to provide visibility from vehicles. In addition to gaining experience, you can see through the window if some special event is happening, so taking this function into account, the window can also save lives. In terms of the window's view functions, it should be as large as possible, but the material of the window, in addition to the application of current technologies, does not allow it to take up the same amount of load and even variable direction as the metal material of the cabinet frame. Windows made of tempered glass can only absorb loads from a certain direction, a small dynamic impact on the edge of the window can cause the window to crack. The task of the window is to absorb the effects from the external environment, this includes absorbing the forces from the pressure wave of the opposing train. Based on calculations, a 1400 mm wide window takes approx. 2 tons of force in a tunnel at a speed of 200 km/h. Despite the above parameters, the window also functions as an escape route with the help of a window-breaking hammer. The window must be of such

a construction that even a smaller female passenger can escape if necessary using a hammer. According to the above, you must perform the following functions without claiming to be complete:

- providing a view
- cheap, assemblyable, manufacturable design
- heat, rain and sound insulation
- recording of pressure waves
- providing the possibility of escape.
- ensuring general travel safety.

6.2 Summary of function provision

Based on the above, we can see that in the relationship between the cabinet frame and the window, treated as a system, several functions are fulfilled in such a way that the common functions of the individual components had to be reduced compared to the 100% theoretical performance of the given element. There is a decrease in the performance of each function, so even in the case of the performance of the equivalent function resulting from the consideration of sub-functions, the missing percentages are filled by the passengers who travel in a sober manner. A responsible passenger will probably not break the window glass with a hammer at a speed of 200 km/h, because the depression following a possible pressure wave can pull anyone out of the train. The railway is a dangerous operation, the traveling passengers must pay extra attention in order to achieve safe transport. In a railway vehicle, in addition to the part connection mentioned in the example, there are hundreds of similar connections, but even with the most careful planning, safe transportation cannot be achieved without the responsible behavior of the passengers. Here, the question is no longer whether the events that are the subject of the meeting will occur, but whether an even smaller inattention can cause a serious accident. Based on experience, in order to achieve safe traffic, it must be enforced with a suitable legal background and made available if necessary, but indirect access is not absolutely necessary.

7 Case studies

Based on the aforementioned, the activities of the NSA HU cover many areas, which is why it has gained experience in many areas. Part of NSA HU's activities is the licensing of large-scale railway stations, underground railways and their structures, as well as ropeway systems.

7.1 Railway systems

From a technical point of view, most questions arise through the provision of rail traffic, high-speed traffic requires a high level of security. During the planning of the systems, the application of legislation, regulations and standards strongly influences the installation of the equipment. High-speed rail transport usually takes place on the surface, and due to the relatively dense tunnels in several countries, special measures had to be introduced in the event of an accident in a tunnel. Taking the above into account, the passengers must take extra care to protect their own and other passengers' physical health. After the train has stopped, you can leave the area of the railway station relatively quickly, but this is only possible under specific conditions. In the present example, it can be seen that the transfer of information must be ensured not only at hubs and railway stations, but also that the information must be carried onto the train during the journey. If a railway company does not have an appropriate contract with an internet service provider operating in the territory of the country it is passing through, then there is simply no internet service on the train. Even the mobile internet service is interrupted on several lines, so only the information that is made possible by the closed railway system gets onto the train.

7.2 Underground systems

In Hungary, the most important underground railways are located in Budapest, the construction of the M4 subway and the renovation of the M3 subway presented the licensing authority with many tasks. In Budapest, several underground stations had to be built, and during the construction of the ventilation of the stations, ventilation systems that also provided automatic fire protection had to be installed. To do this, it was necessary to take into account that in the event of a fire, 1,000 people can travel on one train, if two trains arrive at the station due to a fire alarm, then from one moment

to the next, 2,000 people must be evacuated from the depths. The burnout of a railway vehicle in the event of a large fire takes approx. 5 minutes, but it can already be preceded by toxic fumes and high heat. In all respects, the potentially burning vehicle must be brought to the first station as quickly as possible, and the passengers must be removed from the station as soon as possible. Not only can perfectly healthy people travel on the subway, but people suffering from various illnesses cannot be excluded. People suffering from mental illnesses can react to critical situations in an unexpected way, the pulsating wind effect flowing from the JET fans can even cause a seizure in some passengers. That is why even more responsibility is placed on healthy people participating in the trip, in such situations, more discipline than usual is expected. The application of clothing raises further questions, the passengers cannot be expected to take part in the trip in non-flammable clothing, unfortunately, people's clothing once caused a very serious accident. Based on the above, extra attention had to be paid during the planning of the subway system, the smoke tests at the stations were a serious task for those conducting the tests. Even lighting a cigarette in the panicked crowd flowing out is highly irresponsible. In the case of automatic control systems, trained personnel are not present on the train, even though panic among the passengers must be avoided by all means, otherwise the passenger exclaiming "Now we all die" could have a critical impact. In the current case, we can see how important the transfer of appropriate information is.

7.3 Ropeway systems

The licensing of ropeway systems also falls under the competence of the NSA HU. Up to 1,000 people can be on several chairlifts at the same time, which is why many circumstances must be taken into account when authorizing. The operator of the ropeway can refuse to let a passenger get on the chairlift if he finds the passenger unfit to use it. In the former case, well-trained specialists will take care of rescuing the passengers.



1. Picture: rescuing those in trouble

Based on picture 1, we can understand why the operator of the equipment can impose special conditions on the passengers. Unfortunately, it may happen at any time with any means of transport that such techniques have to be used.

7.3.1 Sátoraljaújhely

Hungary's the currently longest ropeway and the only ropeway with cabins can be found in Sátoraljaújhely. The geometric arrangement of one of the ropeways is very rare. The task of the ropeways will be to serve Hungary's only suspension bridge that is currently in operation, which will be the one of the longest in the world at the moment.



2. Picture: The bridge of national unity

The bridge shown in the picture can be reached with the help of one of the chairlifts, but several questions had to be answered in terms of authorization. Based on the unofficial data of the owner, approx. 140 people can cross the bridge in 1 hour, however, the cable car takes approx. It has a transport capacity of 1000 people. The capacity of the cabin elevator is smaller than this, but passengers can also arrive from the sliding track. In the space in front of the bridge, therefore, up to 2,000 passengers can accumulate relatively quickly, despite the fact that the authorization of the bridge does not fall under the competence of the NSA HU, when authorizing the cable cars, the effects on the cable car of people wishing to cross the bridge under construction could not be ignored. The equipment is located in a wooded area, and as a result of a forest fire or similar event, a panicked crowd may want to attack the cable car. It was confirmed that passengers can leave the area on the service road leading to the area. Based on the above, the operator of the equipment can introduce additional restrictions to the area, not only a fire, but even lighting a cigarette can have serious consequences. If a railway company concludes a contract with the operator of the above equipment for the sale of combined tickets, this ticket may contain information, prohibitions and restrictions.