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**Railway Reform and Review**

**Questions related to the Inland Transport Committee  
Working Party on Rail Transport**

**Submitted by the Government of Hungary**

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1. Introduction

Taking into account the principles of sustainability, it will become an increasingly important aspect to satisfy our growing needs with the least possible use of the environment. Development includes the fact that people travel in addition to other activities, and transport systems must work together to satisfy these needs. In terms of transport within the European Union, it is still difficult to break away from the current state and provincial borders, even though the real needs may arise regardless. The possibility of travel means freedom for the individual, living in a free environment, people cannot be restricted in making their travel decisions. The expected task of the Inland Transport Committee Working Party on Rail Transport Group of Experts on International Railway Passenger Hubs conference number ECE/TRANS/SC.2/HUBS/2023/7 will be to create the principles for traffic optimization.

2. Description of current circumstances

Currently, transport systems are financed within state and provincial frameworks. In Europe, you can find many examples of the fact that transport between the provinces of countries is very difficult, despite the fact that there are no technical obstacles, even though considerable money has already been spent on technical implementations. In many cases, the only way to travel between settlements separated by national borders is to travel to a nearby large city or capital in each country, which is an unnecessary waste of time and a senseless expense for the traveler, and also appears as an unnecessary capacity requirement for the transport systems. In several cases, transport companies do not advertise the transport options offered by competitors in the hope of greater profit, but few realize that there is a real loser: the passenger. Having mapped the situation with incomplete information, the person who wants to travel makes a decision that is unfavorable from the point of view of the transport companies.

Question 1: Is there a higher-level procedure in progress, the task of which is transport unification?

Question 2: Are the point of view of countries outside the European Union taken into account?

2.1 Current capabilities

Figure 1 shows the largest cities in Europe, these cities have increasingly large agglomerations, and in several cases the number of inhabitants is significantly decreasing. The railway connection between several cities is realized with more than 2 transfers. The railway is usually preferred when choosing transport modes, but the current system leaves no other choice, even in the case of cities that are not too far from each other, flying is the best solution.



Figure 1 Europe's largest cities

Question 3: Are there procedures in progress whose task is to map the expected changes in the largest cities?

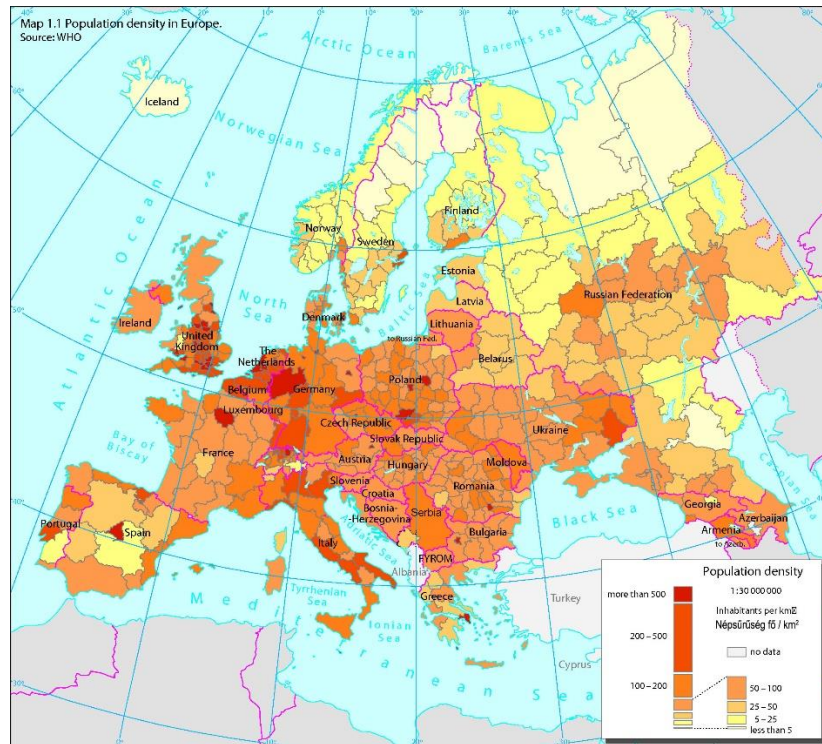


Figure 2 Population density of Europe

The population density of Europe shows a very variable picture, with an adequate transport system. By definition, a larger number of travelers is expected from an area with a higher population density.

Question 4: Are there procedures in progress whose task is to map expected changes in population density data?

## 2.2 Main characteristics of modes of transport

In general, it can be said that in the European transport organization, competition is the determining factor between certain modes of transport, usually to the detriment of other modes of transport. Ensuring the spirit of competition is the basis of development, this is not always achieved in a passenger-friendly way. Transport is part of the state public service, profitable transport cannot be realized on several sections, the loss of low-traffic railway lines must be covered by the profits of high-traffic railway lines, however, without the traveling public flowing from the secondary line to the main line, the traffic of the main line will be lower.

### 2.2.1 Road transport

Road transport is the freest form of all modes of transport, especially with regard to transport by car. The expected traffic is related to the population density. At the moment, the vast majority of internal combustion engines are still in operation, a lot still needs to be done for the development of battery-powered vehicles, and there are still serious questions regarding the impact of batteries as a resource on the environment. If possible, it is advisable to limit passenger car traffic, because no matter what kind of environmentally friendly technology vehicles are born in the future, this form will definitely have the greatest impact on the environment. In the case of bus transport, these rates are already more favorable. In sparsely populated areas, it is no longer certain that the construction of a larger capacity transport system is recommended, this form of transport will probably remain.

### 2.2.2 Water transport

The role of water transport can only be counted on to a significant extent where there is a larger surface of water available. Water transport is slow, and in the case of passenger transport, tourism is more suitable. In the case of larger cities with rivers or bodies of water, it can also be implemented at the local transport level. From the point of view of transport to the islands of Europe, in many cases only ferry transport can be considered, in several large European cities good transport links of ferry ports have already been solved. In several cases, the use of water transport provides a suitable opportunity to relieve the burden of urban transport. Non-perishable goods can also be transported on rivers, but the winter weather significantly limits capacity.

### 2.2.3 Air transport

As a means of long-distance transport, it often happens that air transport is available in conditions where the journey could be made even by bus or train in a shorter time. From a technical point of view, short plane journeys also put greater strain on the vehicles, and the traveling public is forced to endure unnecessary airport check-in procedures. In general, it can be said that the airports listed below are provided with some kind of rail connection, the direct high-speed connection is no longer possible in all cases.

1	London Heathrow Airport	United Kingdom
2	Istanbul Airport	Turkey
3	Paris Charles de Gaulle Airport	France
4	Madrid Adolfo Suarez-Barajas Airport	Spain
5	Frankfurt International Airport	Germany
6	Amsterdam Schipol Airport	Netherlands
7	El Prat Josep Tarradellas Airport	Spain
8	Munich International Airport	Germany
9	London Gatwick Airport	United Kingdom
10	Istanbul Sabiha Gokcen Airport	Turkey

Table 1 Busiest airports in Europe

#### 2.2.4 Rail transport

Of all the possible modes of transport, rail transport has the fewest degrees of freedom and the most constraints, but in the case of moving large masses of people, this feature can be an advantage. The railway is best suited for the efficient movement of large numbers of travelers and the transport of large quantities of goods over long distances.

	City	Station	Passengers (million / year)
1	Paris	Gare du Nord	292.2
2	Hamburg	Hamburg Hbf	196
3	Frankfurt am Main	Frankfurt(Main) Hbf	179.9
4	Zürich	Zürich HB	154.6
5	München	München Hbf	150.7
6	Paris	Gare de Lyon	150.2
7	Rome	Roma Termini	150
8	Berlin	Berlin Hbf	120.1
9	Milan	Milano Centrale	120
10	Berlin	Berlin Friedrichstraße	95,6

Table 2 Busiest train stations in Europe

Table 2 contains the busiest railway stations in Europe, we have to ask the question whether the additional goal is to increase the traffic of the above stations, or if less important stations are given a greater role. The role of railway transport in international transport is of increasing importance, which is contributed to by the constantly opening high-speed lines, but in several cases this causes major disturbances in German and Swiss punctual transport. In terms of suburban traffic, the transfer of the traveling public to the city center can be ensured smoothly, however, the capacity of the vehicles must be sized primarily for the morning, and secondarily for the afternoon peak traffic, and it may be possible to expect unused capacities at other times. However, some types of vehicles are suitable for driving on low-traffic track networks, and even from the point of view of track maintenance, the valuable track material is used on the side lines.

- Rhätische Bahn

The Rhätische Bahn is a railway network with a gauge of 1000 mm in Switzerland, which practically operates as a closed network. In addition to being a tourist attraction, it also serves several settlements that are difficult to access by car, and practically impossible in winter. The railway operates on difficult sections in the mountains, on these sections the speed can be increased at unreasonable costs. The stations were built in such a way that the trains can be operated according to the timetable. It is easy to adjust maintenance to this schedule, which becomes routine over the years. They bow to Swiss precision all over the world, but it is not difficult to achieve under these conditions. The age of the vehicles exceeded the age of European vehicles, however, due to regular maintenance, the vehicles were and are in perfect condition.

Question 5: Are there procedures in progress whose task is to coordinate the various modes of transport as closely as possible, taking into account the aspects of intelligent transport?

### 2.3 Current views

If we want to optimize our systems, then we have to break with our current approach, because whether we look at the legal or the technical side, we give ourselves unnecessary work that does not bring us closer to the goal. We have to put our perspective on a new basis, in mathematical terms, we have to establish a new coordinate system by revising the old coordinate systems, because by setting up a new coordinate system, solutions that seemed meaningless until now can gain meaning. The most obvious example is that Hungary is a country with a small area, it makes no sense to build a high-speed network, because the distances are also small. This phrase was created several decades ago, but circumstances have changed so much that it is no longer absolutely necessary to stick to it.

### 3. Future goals

The purpose of the current conference is to answer questions from a professional perspective. Our goal is to build an intelligent railway, but an intelligent railway does not exist if it does not provide an intelligent system response to events from the outside world, an intelligent response only exists if only intelligent signals arrive from the outside world. In more than one case, we have justified the right to build a transport system by saving time for those taking part in the journey. If, in addition to the intelligent railway, other systems also operate intelligently, then in the event of a disruption, by minimizing the time of the traveling public, the invested work and money can pay off very quickly.

#### 3.1 Future perspectives

In order for the systems to function properly, we must break with our traditional views, we must break with the view of national borders and provincial borders, especially from a transport point of view, and imagine a borderless Europe that interacts as a unit with the influences of other continents. For this, the concept of the European Transport Area must be introduced, which promises to achieve ideal conditions. In this space, the transport systems work in such a way that they complement each other in order to satisfy the needs of the traveling public, the traveling public has all the information they need for their journey available, their rights and obligations are clarified in all cases during their journey, and they have bought the most optimal ticket possible ( or paid the most optimal price), which you can use as widely as possible.



Figure 4 Outlines of Europe

### 3.2 Functional approach

In the automotive industry, in the field of large-scale production, several methods are used for the purpose of production efficiency, for a component manufactured in the order of several million, every penny is important. Several companies use TPS (Toyota Production System) and value analysis methods. The purpose of the former is to optimize work, in the latter case we ask the question of how much the customer is willing to pay for which function. This approach can also be transferred to railway technology, because the traveling public may consider it more important that the train arrives on time and that a suitable flexible connection is available than that the journey takes several hours less time.

### 3.3 Dynamic system approach

Based on practical experience, a disruption in today's railway transport can start such a wave that it no longer stays within the borders of one country, the disruption can even spread to several neighboring countries. This disrupts the traffic order, and normal traffic can only be restored with a significant delay. The opening of a new railway line may result in unusual operation in rail transport for a while, which must be restored as soon as possible. No matter what measures or investments are made, there have always been disturbances, there are, and there will be even in the case of a fully developed intelligent railway. If we set up a suitable model, the corner points of which are the above-mentioned railway stations, the consequences of the disturbance become easy to manage. If it is possible to set up a dynamic model similar to an oscillating system for the case of each corner point, then the system response to disturbing signals acting on the elements of the system can also be calculated. In this way, the harmful effects of a disruption at an airport can be mitigated by rail transport. For this, from a marketing point of view, railway transport must be positioned in such a way that in the eyes of the traveling public, the railway can be a cornerstone of reliability. The choice of the exact model and the determination of the constants go beyond the current framework, but the effects of a disturbance can be illustrated. In the case of a successful model selection, it can be determined which type of transport construction will be the right choice.

Question 6: Are there procedures underway to build a new type of model system?



4. Organization of maintenance

We are constantly talking about the construction of the network and the purchase of vehicles, which represent a large cost, but it can be proven that the maintenance of a vehicle far exceeds the purchase costs. The maintenance of railway systems can cost even more over a long period of time than the costs of the entire implementation, so maintenance activities must be carefully planned.

4.1 Maintenance of vehicles

Vehicles are maintained at maintenance sites. The construction of maintenance sites must be carried out in accordance with the above, because any unnecessary conversion affecting each maintenance site entails serious costs. In general, a vehicle is designed for a lifespan of 30 years, but it is expected that this limit will certainly be exceeded, the number of years spent in scheduled traffic of successful constructions can be up to 50 years, they can spend even 10-20 years on sidings, the lifespan of nostalgia vehicles can exceed 100 years. If, due to a minor design error, the replacement of a part takes an hour longer, the additional costs resulting from the labour fee, the number of vehicles and the product of lifetime maintenance activities can already be very significant. During the maintenance of vehicles, different levels of maintenance activities have to be carried out, few maintenance units are suitable for higher level maintenance activities. A significant part of the vehicle's lifetime is spent on maintenance activities, and in several cases, the vehicle may have to travel long distances during service. The material transport turnover of the railway maintenance and production units is very high, in many cases it is necessary to think about accessibility by road and even by water. In the absence of an inadequately careful organization of maintenance, very large costs can arise, which the railway companies charge to the customer or the passenger. Maintenance activities cannot be separated from scheduled traffic, it is advisable to plan higher level maintenance activities for stations with higher traffic. Today, it is also necessary to take into account that the maintenance activities of some vehicles are no longer carried out at the same site, or even in the same country.

Question 7: Are there procedures in place to intelligently coordinate maintenance activities of vehicles?

4.2 Maintenance of infrastructure

Infrastructure usually means the railway track and its accessories, however, with the development of technology, other trackside equipment also play an increasingly important role. In many cases, there is no automatic connection between the individual elements, however, the operation of more and more equipment can directly affect the traffic of trains. Therefore, the maintenance of the infrastructure must also be seriously organized. It may happen that the maintenance of the infrastructure can limit the operation of trains on some lines, but it must also be taken into account that in several cases line sections have to be closed for longer or shorter periods of time, this can increase the time spent on the trip, but it can seriously affect the comfort of the trip.

Question 8: Are there procedures to integrate maintenance activities of infrastructure?

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