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RAILWAY IN THE FUTURE DEVELOPMENT OF THE TRAFFIC SYSTEM

ABSTRACT

Future development of traffic assumes its growth with increased energy consumption, greater environmental pollution through harmful components, and noise, as well as overload of traffic routes. The same development has been burdened by two opposing tendencies. One is subjected to short-term interests and oriented exclusively to profit, the other is a long-term care of environmental protection and energy savings which often excludes immediate profit. Giving priority to this second tendency is a must, and it requires joint efforts invested by scientists, traffic entrepreneurs and government institutions within legal regulations.

This paper analyses the advantages of railway traffic compared to other modes of traffic and indicates its potentials in the future development of traffic primarily from the aspect of environmental protection. The emphasis lies on the comparison of harmful emissions and consumption of specific energy in cargo transport by railways and other traffic modes. The directives are also given of the desirable future development of railways in order to optimally use all its potentials.

KEY WORDS

railway traffic, environmental protection, cargo transport, future development

1. INTRODUCTION

Traffic, like other human activities pollutes the environment. Air pollution, harmful gas emissions, and increase of noise have been increasingly disrupting the ecological balance.

By 2005, compared to the year 1988, road traffic is expected to have increased in passenger transport by 25% and over 90% in cargo transport [1]. Although motor vehicle manufacturers are managing to gradually reduce the specific consumption of fuel by various measures, the forecasts say that emissions of CO₂ will increase over the given period by more than 40%. Considering the adverse impact of CO₂ on the environment, creating greenhouse effect, and the international efforts in reducing CO₂ emissions, their con-

stant increase over long-term is reason enough for worry.

Every environmentally aware and responsible country, or a signatory party of adequate international agreements on environmental protection, has to implement an active policy of protecting the environment.

Recognising all the negative effects on the environment and lives, the UN Economic Commission for Europe (ECE) accepted in 1997 in Vienna the Declaration on Traffic with the aim of directing the efforts of the ECE member countries towards achieving greater ecological safety in traffic based on the concept of sustainable traffic, whose principle apart from environmental and health protection also includes the principle of charging for pollution.

The Vienna Declaration obligates Governments to promote efficient and sustainable traffic systems, i.e. to redirect passenger and cargo transport from road and short-haul air transport to transportation with lower specific harmful emissions and lower fuel consumption, primarily to railways and combined transport.

The history of development of the environmental protection legal system in Croatia is short but of high intensity, and it began by the Croatian Constitution in 1990 and the Declaration on Environmental Protection in 1992. Numerous regulations have been accepted, and most of these have been harmonised with international regulations. The Law on Environmental Protection was brought in 1994, Law on Protection of Nature in 1994, Law on Waste Management in 1995, Law on Air Protection in 1995.

The International Railway Union (UIC) and the Community of European Railways (CER) have informed the public that they have started to develop a study entitled "Railway and Changes in Climate". It deals with the influence of various traffic branches on the environment and potentials of railway traffic in reducing the emissions of the so-called greenhouse gases into the atmosphere.

Since care for the environment in Croatia is mostly only declarative and far from being institutionalised, this well-thought and pro-ecological traffic policy is yet in its infancy. In economic and political circles not much is being said about the railway traffic as the ecologically most favourable of all the traffic branches and that it should be improved. On the contrary, due to insufficient traffic volume, only the relation between costs and profits is considered resulting in the conclusion that the railway is often unprofitable and that traffic on some lines should be closed down. Road network is developing with great emphasis and road traffic is preferred. The development of railways has been recently completely neglected, which is contrary to the trend in relation to the developed part of Europe.

The analysis of basic potentials and advantages of railways in relation to other transport modes in this paper is to indicate the stressed need of developing railway traffic and its institutional favouring.

2. ADVANTAGES OF RAILWAYS OVER OTHER TRANSPORT MODES

Although road is today the main transportation path, the importance of railways is gaining in significance in the world. From the aspect of environmental degradation, railway traffic is considered the most suitable form of traffic. It occupies least space, it consumes least energy and it pollutes least the air. Railway traffic occupies three times less land than road with approximately the same traffic load. For instance, the need for space of a double track railway line is 3.2 ha/km, and a four-lane motorway needs 9.1 ha/km, with the capacity of railway line being twice that of the road. [2]. A double track line requires space 13.7 m wide, and a motorway with 2x3 lanes needs 37.5 m. Also the need for land per transported person in a car is 9.5 times greater than in railway traffic [2].

Table 1 – Comparison of harmful gas emissions in traffic (g/kWh)

| Type of emission | Road traffic | Air traffic | Railway traffic |
|------------------|--------------|-------------|-----------------|
| CO | 1.26 | 0.51 | 0.003 |
| NOx | 0.25 | 0.7 | 0.1 |
| HC | 0.1 | 0.24 | 0.001 |
| CO ₂ | 111 | 158 | 28 |
| SO | 0.03 | 0.05 | 0.1 |
| PM | 0.01 | 0.01 | 0.02 |

Apart from rationally occupying space, the positive ecological aspect of railway traffic is reflected in the very low harmful emissions in relation to other transport modes. The emissions of unburned HC and CO

generated from Diesel engines has been reduced to a minimum.

Advantages of railway traffic related to harmful emissions can be seen in Table 1 [2]. These data indicate substantially lower emissions of harmful components in railway traffic per unit of work done compared to other transport modes, and this should be one of the strongest arguments in advanced valorisation of traffic and advantages of railway traffic.

Table 2 – Comparison of energy consumption in traffic (cargo traffic)

| Transport mode | Specific energy consumption [kWh/1000 ntkm] | Relation |
|---------------------|---|----------|
| Railway (100 km/h) | 120.0 | 1.00 |
| Truck (100 km/h) | 520.0 | 4.33 |
| Ship | 120.0 | 1.00 |
| Aircraft (800 km/h) | 7570.0 | 63.08 |

Energy consumption is the basic sign of environmental pollution. It influences directly the reduction of natural energy resources, determines the transportation price and results in adequate CO₂ emissions which is considered one of the causes of the greenhouse effect. Energy consumption per unit of transported cargo, depending on the transport mode, has been presented in Table 2 [2]. If transport of cargo by ship is excluded, the transport by railway has several times lower specific energy consumption compared to the transport by truck, and especially compared to air transport.

According to UIC data, the energy consumption per realised passenger kilometre in case of high-speed trains is lower by 30 to 50% than the energy consumption in road traffic [3].

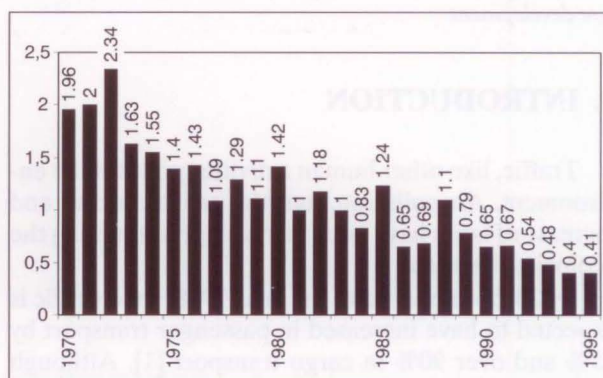


Figure 1 - Number of fatalities per billion passenger kilometres

In railway traffic great significance is laid on safety. The possibility of accident with railway is much lower than on the road. In 1991 in seventeen European countries there were 660 fatalities and 1,300 persons

were injured in railway accidents. In the same year, in these countries, 57,000 fatalities and 4.7 million persons were injured in road accidents. According to the data provided by UIC the safety of railway traffic in EU is increasing every year. In fifteen EU countries, together with Norway and Switzerland the number of incidents per billion passenger kilometres has been constantly decreasing, which can be seen in Figure 1 [2]. Traffic safety on the railways is 24 times greater than in case of passenger cars and 2.5 times greater than in case of buses.

3. POSSIBLE ORIENTATION OF RAILWAY DEVELOPMENT

The previous analysis has emphasised the advantages of railway traffic compared to other transport modes, and therefore the railway in Europe is gaining in significance and role. However, the ever stricter requirements regarding environmental protection have mostly negative influence on the construction of high-speed railway lines. They often cause change in railway line routes and result in expensive facilities which significantly increase the construction price. On the other hand, they give incentive to the application of new technologies such as tilting trains and levitation trains.

The International Railway Union (UIC) administration brought a decision in 1991 about the environmental protection becoming the official policy of the organisation. This decision obligates all the railway union members to activities and operation in compliance with the environmental protection principles.

Croatian Railways joined UIC in 1992 thus accepting the obligation of actively participating in environmental protection. In their "Development Strategy" the Croatian Railways advocate that the traffic policy should take into consideration the European orientation in the domain based on achieving sustainable development with the aim of not endangering the possibilities of future generations to satisfy their needs. The notion of sustainable development refers first of all to the preservation of natural resources and economic development that is environmentally friendly. The term sustainable development determines also the term sustainable traffic, which represents an increase of transport performance with reduced energy consumption, lower noise level, less pollution of air, water and soil, and reduced number of traffic accidents and their consequences.

Strategically, the future railway should represent a permanently suitable transportation means used in the traffic system. In order to reach such orientation, a wide action is necessary and the idea has to be accepted. One of the steps in this direction is also the

Railway Agenda 21, which defines the main tasks and objectives of the railway in the 21st century [1].

In order to develop the Railway Agenda 21, the following issues have to be defined and elaborated:

- What strategic areas must the railway focus on in order to satisfy the ecological, economic and social challenges in the following 10 to 30 years at the same time insuring one's own entrepreneurial success?
- Which projects, programmes and measures are needed to realise this task?
- How is the discussion process to be organised in enterprises including all co-workers, also integrating the creativity and improvement potential of all the employed?

The discussion process at the world level resulted in seven characteristic items. These should be present as basic tasks in every railway administration that makes long-term plans for high-quality development of railway:

1. establish conditions for further shift from road and air traffic to railway,
2. reduction of harmful emissions as contribution to reducing regional load and climate protection,
3. reducing noise in railway traffic,
4. nature and landscape protection,
5. strengthening of the role of railway as part of urban and regional development,
6. increase efficiency in investments and operation,
7. construction of environment management system.

Railway Agenda 21 from Rio de Janeiro 1992, starts from three equally valid basic aims:

- economic efficiency,
- ecological balance, and
- social justice.

These basic aims form the basis of the Railway Agenda 21 resulting in all the future entrepreneurial measures. Programmes, projects and measures are being planned, developed and introduced that are directed to constantly insuring the entrepreneurial development of the railways.

4. CONCLUSION

The analyses of the basic characteristics of railways compared to other transport modes indicate multiple advantages in favour of railways. In combination with other transport modes these advantages are greatly intensified. Due to the increasing load on roads with the tendency of virtual congestion should the present tendency in traffic development continue, railways will have to take over a great share in cargo and passenger traffic.

The basic advantages of railway compared to road and air traffic are reflected in many times lower harmful emissions, lower specific energy consumption, occupying smaller traffic areas, and less noise. Due to these advantages, a share of road and air traffic should be redirected to railway, when this is justified. Here, railway should get support from government institutions by defining the strategic development orientation in traffic and by accepting adequate legal framework that will enable railway to take over the mentioned share of traffic. Such changes have already been taking place in the developed part of Europe, and this tendency should also be followed in the Republic of Croatia.

SAŽETAK

ŽELJEZNICA U BUDUĆEM RAZVOJU PROMETNOG SUSTAVA

Budući razvoj prometa podrazumijeva njegov rast uz povećanu potrošnju energije, povećano zagađivanje okoliša štetnim komponentama i bukom te preopterećenje prometnica. Isti razvoj opterećen je dvjema oprečnim tendencijama. Jedna je podređena kratkoročnim interesima opterećena isključivo profitu, a druga dugoročno brine o očuvanju okoliša i štednji energije koja često ne podrazumijeva trenutnu dobit. Davanje prednosti ovoj drugoj tendenciji predstavlja nužnost, a za to je

potreban zajednički rad znanstvenika, prometnih poduzetnika i državnih institucija u okviru zakonskih regulativa.

U ovom radu se analiziraju prednosti željezničkog prometa u odnosu na druge oblike prometa i ukazuje na njegove potencijale u budućem razvoju prometa prvenstveno s aspekta zaštite okoliša. Naglasak je na usporedbi emisije štetnih komponenta i potrošnji specifične energije u prijevozu tereta željeznicom i drugim prometnim oblicima. Također se navode smjernice poželjnog budućeg razvoja željeznice da bi se njezini potencijali mogli optimalno iskoristiti.

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