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TRAFFIC AND ECOLOGICAL ENVIRONMENT OF CROATIA AS INTEGRATION FACTOR IN 21ST CENTURY EUROPE

ABSTRACT

Considering the current trends, traffic in 2030 will economically and socially burden the society and move away from the sustainability regarding the environment. The paper presents the development orientation of the Republic of Croatia in certain transport branches that will contribute to the efficient environmental protection, since protection of the Croatian natural and civilisation values represents an important strategic orientation of the Republic of Croatia and one of the integration factors of the 21st century Europe.

KEY WORDS

environmental protection, effects of transport on the environment, transport emissions

1. INTRODUCTION

Over the recent 100 years, especially due to the modern development of technology, industrialisation, population growth, intensive urbanisation, and traffic, Man has been disturbing the natural balance of the eco system so much, that he has started to fear for his future prosperity because of seriously endangering the whole biosphere. Even if all of the current, planned and logically predictable legislative, technological and social changes come true, serious doubts about the sustainability of the traffic systems towards the environment would still remain. While the influence of traffic on the environment is increasing constantly, it is becoming clearer that the today's transport systems are not sustainable with regard to the environment, and accordingly, neither towards the society or the economy - in the long run.

Considering that the space is, in fact, the main resource, and that the quality of living is the main objective, there have been warnings that space is not only a resource but moreover, in a certain sense, also the limiting factor of the development. Based on this, the

ecological movements are growing and constantly becoming stronger, and from their European environment they activate the ecological awareness in Croatia. Along with positive effects, the Croatian ecological public is becoming stronger, and the whole set of related questions imposes the requirement for the affirmation of the ecological criteria as the target orientation of the Republic of Croatia.

When speaking of transport, the aims regarding environmental protection can be achieved by simultaneous appropriate planning and construction, within exploitation by appropriate restrictions, technical regulations and even prohibitions.

As a Mediterranean and Central European country, Croatia has a favourable geographic - traffic location. Important international transit routes pass through her territory, connecting Western and Central Europe with the South-eastern Europe and Asia. Considering the specific shape of her territory, the developed transport network is important for establishing good connections between the Croatian regions.

Some general orientations, such as stimulating the usage of public transport, restricting individual traffic, and in a wider sense, the general development policy, regarding distribution of economic activities, and therefore also the population, can contribute to the decrease in the general needs for communication and reduction of traffic load. Such tendencies may be expected in the development phase, as resistance to over-agglomeration which is contrary to the essential tendency towards better living conditions with strong support in the nature and the appropriate ecological qualities.

In order to achieve positive effects in the field of environmental protection, not only declarative commitments and their strict compliance should be considered, but also the costs whose existence is becoming clearer and in amounts greater, so as to transfer the overall costs covered by the society regarding environmental protection, as much as possible onto the causes

of the problem. In traffic, such approximations can be measured, so that the development criteria and the appropriate target decisions need to take them into consideration. Preservation of natural and civilisation values of the Croatian territory is, after all, an important strategic orientation of the Republic of Croatia, and therefore of the traffic development in particular. [1]

2. CURRENT SITUATION

Traffic is one of the main guidelines in the environmental activities. The reasons are the following:

- the increasing number of vehicles results in the constant increase of energy consumption, greater emissions of carbon dioxide, volatile organic compounds (VOC), NO_x, ozone,
- in urban environments, people are exposed to high levels of air and noise pollution,
- regional and local problems of pollution, significantly helped by traffic, are increasing constantly,
- the number of vehicles and therefore, the volume of traffic are constantly increasing, leading to excessive traffic congestion in the urban areas and increasing air pollution pressures,
- with the number of vehicles increases also the amount of waste,
- sea transport by tankers and ships transporting dangerous cargo along the coast, presents a real danger with unthinkable consequences for the coast and the sea.

Traffic is regarded as one of the major causes for health problems related to the toxic pollutants in the air. These pollutants reach the water flows, and thus further pollute the eco-system and endanger human health. Other local influences, including noise and various forms of soil pollution, significantly disturb the eco-system. An overview of the major types of effects exerted by various aspects of traffic on the environment, is presented in Table 1. [4]

The usual methods of reducing the impact of traffic on the environment have taken the observed and foreseen traffic trends as known facts, and have tried to assess their impact on the environment by feed-back approach. Such approach has resulted in greater efficiency and has helped to reduce certain dangers for the environment and health caused by traffic. However, all this could not bring about the realisation of long-term objectives of environmental protection, which means that new policy is needed which would place the environmental protection at the top of the list together with other policy objectives.

The effects achieved in the reconstruction and development of the traffic system in Croatia over the period following 1991, and especially after the war, will

be reflected in the gradual improvement of environmental protection.

2.1.1. Railway Traffic

The aim of the European traffic policy is the traffic sustainable over a mid- and long-term period, and finding of transport methods most suitable to the environment. Railway can certainly offer advantages both in cargo and passenger transportation. Therefore, the administration of the International railway union (UIC) made a decision, back in 1991, including the environmental protection into its official politics. By this decision, all the member railways are obliged to act accordingly within their companies. The Croatian Railways have been UIC member since 10 June 1992. By joining the association they have accepted the obligation to participate actively in the protection of the environment.

The main aims in implementing the environmental protection as part of the business policy of HŽ (Croatian Railways company) are the following: [2]

- to improve the quality and quantity of transportation services, so that the existing or potential adverse effect on the environment is reduced to a minimum,
- to achieve and maintain accordance with laws and regulations in managing the company,
- to recognise and prove the need for sustainable development of railway traffic over a longer period of time.

Concretely, in the case of Croatian Railways, this means:

1. *Prevention* - for every investment (project) an analysis has to be made or requested, considering environmental protection (most of the products already have such an analysis in their declaration, but it needs to receive appropriate attention, because sooner or later all the products, after their service life is over, become waste, which has to be disposed of according to economic principles and principles of environmental protection, and this has to be paid for).
2. *Increase in traffic (cargo and passenger)* - proving the advantages of railway transportation with the aim of saving energy and preserving air quality by re-directing the cargo transportation from other means of transport - using the motto "think globally act locally".
3. *Reduction of energy consumption* - in any form (primarily referring to driving power for the locomotives, and the consumption of fossil fuels), and by electrification of railway lines.
4. *Reduction of fresh water consumption* - Checking of water supply systems and necessary reconstruction).

Table 1 - Impact of various types of traffic on the environment

Traffic activity	Environmental elements			
	Air	Water	Soil / ground	Nature & animals / landscape
Road traffic	<ul style="list-style-type: none"> - combustion of liquid oil fuels → emission of NO_x, CO, CO₂, volatile organic compounds (e.g. benzene), lead, and explosives → local and global effects on environment and health - emissions of NO_x and VOC influence the tropospheric O₃, - noise 	<ul style="list-style-type: none"> - water drainage from the roads that contain oil, salts, solvents → pollution of surface and underground water - emission of NO_x and SO₂ → acidification - roads → changes in hydrological system 	<ul style="list-style-type: none"> - road construction → land used for infrastructure and servicing facilities → pollution and division of land resources - transport of harmful substances → danger of ecological disasters → soil pollution and human victims - discarded vehicles, waste oil, batteries, old tyres, old cars → waste disposal issue 	<ul style="list-style-type: none"> - obtaining material for road construction → landscape degradation, - infrastructure → division and separation of habitats, possible barrier to animal migrations
Railway transport	<ul style="list-style-type: none"> - electrical power generation for powering electric railcars → air pollution - diesel trains → emissions into the air 	<ul style="list-style-type: none"> - railway → changes in the hydrological system 	<ul style="list-style-type: none"> - transport of harmful substances → danger of ecological disasters 	<ul style="list-style-type: none"> - dilapidated objects not used any more → degradation of the landscape - railway infrastructure → possible barrier to animal migrations
Water traffic (sea and inland)	<ul style="list-style-type: none"> - harbour activities → air pollution - closed seas and water navigation routes → air pollution - storage and loading of fuel → emissions into the air (VOC) 	<ul style="list-style-type: none"> - discharge of waste waters from ships → water pollution - discharge into the sea due to ecological disaster or emergency (incl. oil) → water pollution - waste sewage waters and waste from the ships → water pollution - anti-vegetative paints → water pollution - transport of dangerous substances → danger from possible accidents 	<ul style="list-style-type: none"> - disposal of material dug out during construction of canals → waste disposal issue 	<ul style="list-style-type: none"> - construction of anchorage and loading canals → effects on the landscape - dilapidated terminals → effects on the landscape - construction of river canals → effects on the landscape
Air traffic	<ul style="list-style-type: none"> - aircraft → emissions of NO_x and CO₂ (high levels of emissions, especially during take-off, taxiing and landing) → low ground smog and acid rain - damaging stratospheric ozone and global warming - additional road traffic in airports → higher emissions 	<ul style="list-style-type: none"> - drainage of excessive water from the airport, which contains liquid oil fuel and antifreeze → water pollution - construction of airports → changes in the hydrological system 	<ul style="list-style-type: none"> - construction of airports → burden on the land resources 	<ul style="list-style-type: none"> - obtaining material for the construction of airports → landscape degradation - construction of airports → changes of landscape - construction of airports → dispersion of ecological regions
Pipework	<ul style="list-style-type: none"> - air pollution (CH₄) → global warming 	<ul style="list-style-type: none"> - oil discharge → possible water pollution 		<ul style="list-style-type: none"> - possible barrier to animal migrations, if above ground

5. *Protection of underground and surface waters and water flows* - (necessary reconstruction of drainage systems with pre-treatment of waste waters).
6. *Reduction of the number of locations for workshops and washing facilities for railway vehicles, and reduction of filling stations* - (quality washing facilities and workshops at several locations, and not in every major or minor railway station).
7. *Responsibility, education of personnel and regular control* - (depots - workshops for the maintenance of the railway vehicles, filling stations, railway vehicles washing facilities etc.).

During the next period it is necessary to gradually realise a comprehensive program of reconstruction and modernisation of the railway, in order to win stronger recognition of the railway traffic within the Croatian traffic system, as type of transport which is more economic regarding power consumption and environmentally friendlier. In this process, Croatia is, in accordance with the West European tendencies, giving special significance to the implementation of combined transport, primarily for the protection of environment, tourism, and for re-directing the cargo transport to the railway.

2.1.2. Road Traffic

The total length of the existing categorised roads according to the latest list from 1995, amounts to 26,928 km, out of which 4,740 km are main roads, 7,588 km regional and 14,600 km local roads.

The number of motor vehicles is greatly increasing. However, there is a great increase in the number of cargo vehicles, which certainly leads to a higher environmental pollution. The number of passenger vehicles is also increasing within the structure of the overall number of vehicles, resulting in heavier road traffic.

At the end of 1996, 1,050,035 road motor vehicles were registered, out of which 4,543 buses and 86,041 cargo vehicles, and 828,441 passenger vehicles (recorded on December 1, 1996). The average vehicle age was 11.5 years, but the age of 10% of vehicles was under 5 years. There is a gradual increase in the number of cargo vehicles with eco-engines, primarily in international road transportation [4].

In spite of an extremely favourable geo-traffic position, Croatia has not got adequate traffic connections with Central Europe. The reasons should be looked for in the different previous social and political development of Croatia, insufficient traffic network in Croatia itself, and also in the insecure political circumstances in this part of Europe today. For normal integration in the European road network, Croatia would need to build about 1,000 kilometres of motorways, whereas only a third have been constructed, i.e. about 360 km. [3] The adverse effect of road transport on the

environment is notorious, and manifested as air, water and soil pollution, and in the noise and vibrations, in negative impact on the environment as a whole, taking over green zones and vital areas in overpopulated regions, through intrusion and visual degradation of the natural and urban spaces, as well as in the greater danger to lives and health of people.

Planning and construction of modern traffic routes need to be specially analysed from the ecological aspect, in order not to destroy valuable land. However, rational usage of areas for traffic purposes has not yet been the topic of discussions led in Croatia. It should be noted that land usage for traffic purposes i.e. the change of the intended use in favour of traffic infrastructure, represents a significant element of the long-term development and physical planning of any country, including Croatia. The reason is the limited space, and within the conditions of current development and population density, this issue needs to be considered with special attention. Although the burden of this issue is not yet as pressing in our country as it is in the highly developed countries, still it needs to be attended to before the area gets irretrievably endangered.

The road is, and will remain so for long, the main overland transportation route, although the advantage of railway is constantly increasing.

Because of environmental protection, many countries have tried to stimulate purchase of cars that use lead-free petrol and have catalysts. Croatia had, until the end of 1993, a regulation included in tax provisions according to which the tax rate for vehicles with catalysts was reduced by 10%. Then, this tax benefit was revoked. The regulations on technical performance of vehicles in road traffic includes rules on the allowed concentration of carbon monoxide, and has determined a new obligation for buses and cargo vehicles registered for the first time in Croatia, as well as for the vehicles intended for transport of harmful substances, according to which they have to be fitted with a speed limiting device (this obligation has been valid since January 1999) - for cargo vehicles at 85 km/h and for buses at 100 km/h.

2.1.3. Air Traffic

Air traffic is increasing intensely, so that in 1996, 823,010 passengers (474,896 in international traffic) were transported. Figure 1 shows the traffic of passengers and cargo in the air transportation of Croatia.

Republic of Croatia has been an acknowledged member of the UN, from January 15, 1992, and has therefore become full member of ICAO on May 9, 1992, thus ratifying the Chicago convention and the related documents. Regarding purchase of low-noise mid-range aircraft, Croatia Airlines has already made a step forward and signed a contract for

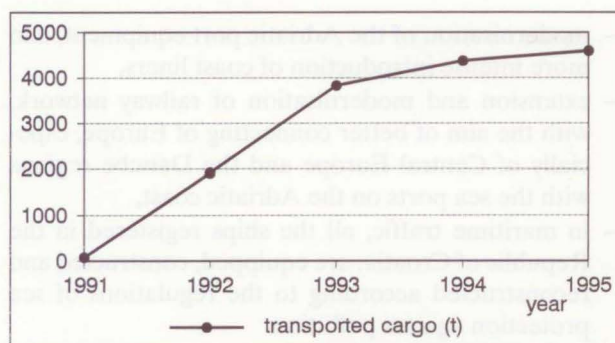


Figure 1 - Passenger and cargo transport in air traffic

purchasing six new Airbus A 319 aircraft, whose delivery is expected somewhere in the period between 1998 and 2000. In order to increase safety and to reduce penalties at the European airports, Croatia Airlines has already rented two aircraft A 320. These measures are in accordance with the international conventions ICAO and ECAC, and constant monitoring of the impact of noise on the environment is being introduced at the airports.

Regarding other factors of environmental protection, such as engine emissions, waste treating and recycling, etc. one may say that little has been done compared to the competition, and that this should be improved in the future. Airport capacities will satisfy the traffic needs, depending on the traffic facilities and areas, up to the period of 2000 and 2005. During this period the capacities for handling passengers, luggage, cargo, post and aircraft, as well as the accompanying structures and areas will have to be increased. A special issue within the strategy of airport development is the issue of minor airports, primarily on the islands for better connections and easier arrival of tourists to their destinations.

The flight control will adjust its development plans with the international government organisations in order to define the shortest routes between airports in Europe, i.e. increase of the European airspace capacity, which is already congested in some areas.

2.1.4. River Traffic

Considering the European trends of redirecting the most part of cargo transport from road to combined railway, river and sea transport, because of the environmental protection and reduction of transport costs, river transport offers comparable advantages for a more intense development.

In order to establish navigation, renovation and development of river traffic as one of the most acceptable means of transport from the point of view of the environmental protection, various organisational, technical, technological and normative activities are being undertaken.

The navigable waterways of the rivers: the Sava up to Sisak, the Drava up to Osijek, and the Danube, have the status of international navigable waterways, and the same status is determined as well for the planned Danube - Sava canal. The river ports in Sisak, Slavonski Brod, Osijek, and Vukovar also have international status, and soon they will be included in the system of international ports for combined transport.

The ports in Sisak, Slavonski Brod, Osijek, and Vukovar have been greatly damaged and destroyed during the war, and this has also affected their systems for protection against water pollution. All our ports need to be equipped by devices and equipment for disposing of waste harmful to the environment, in accordance with the international conventions.

Since the Republic of Croatia is a member of AGN and AGTC, according to the accepted obligations included in the multilateral international contracts, the navigable waterways of the Sava and the Drava need to be improved and modernised for the higher (international) category of navigability, and the ports need to be equipped and reconstructed for the international combined transport.

The construction of the multipurpose Danube - Sava canal is in the preparation phase. It will shorten the navigable route towards Central Europe by 417 km, and towards the East by 85 km.

2.1.5. Sea Traffic

The Republic of Croatia covers three European regions, and the Mediterranean region is extremely important for the maritime traffic.

By 2010, great modifications and great investments are needed, so that the Croatian maritime shipping and sea ports would reach the significance that they actually deserve. Apart from developing the national merchant shipping transporting cargo, it is very important for Croatia, as a maritime country with a long and indented coast and many inhabited islands, to develop passenger shipping. The current situation in the national passenger shipping is very unfavourable, and the existing fleet is obsolete. Passenger shipping in Croatia includes a total of 62 ships, out of which 40 ferryboats and 22 passenger ships for about 21,500 passengers. [4]

In order to redirect a part of transit cargo and passenger flows from Central Europe to Greece, fast ferry boats with departures from Rijeka need to be introduced. Later, after the motorway Graz - Zagreb - Split is completed, a part of flows from Central Europe will be directed from the Šibenik and Zadar ports and further by fast ferry boats to the Greek ports.

Connecting of the Croatian and Italian Adriatic coast by fast ferry-boats also needs to be considered with appropriate priority.

3. CONCLUSION

The expected technological advancement will not be sufficient to overcome the increasing impact on the environment caused by the growing traffic demand. Based on the current trends, by the year 2030 the traffic will burden the society both economically and socially, and the sustainability regarding environment will diminish.

Measures of economic policy will be used to insure orientation towards those means of transport that are more environmentally friendly. One of the general strategic objectives of the traffic development is to insure that the restructured and newly constructed traffic systems abide by the highest criteria of environmental protection.

Certain traffic branches foresee the following development guidelines in Croatia which will contribute to a more efficient protection of the environment: [4]

- development of combined transport railway / ship and railway / road vehicles, and modernised equipment of container terminals for cargo handling,
- introduction of environmentally friendly motor vehicles into road traffic,
- improvement of infrastructure of the river waterways and the related ports,

- modernisation of the Adriatic port equipment, and more intense introduction of coast liners,
- extension and modernisation of railway network, with the aim of better connecting of Europe, especially of Central Europe and the Danube regions with the sea ports on the Adriatic coast,
- in maritime traffic, all the ships registered in the Republic of Croatia, are equipped, constructed and reconstructed according to the regulations of sea protection against pollution.

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