adversely affect the results of the test. Multiple use of sand is not recommended.

The selected coatings are particularly resistant to abrasion wear and can be applied to the demanding parts of modern agricultural technology.

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PUBLIC TRANSPORTATION AS A REDUCTION FACTOR OF TRAFFIC CONGESTION IN URBAN AREAS

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Abstract:*As a residents of urban areas, everyday we witness increase in the number of registered vehicles that daily move through urban zone of small, medium and large cities. Such an increase in vehicles number results in various forms of congestion like gas emissions and air pollution, usage of traffic areas and daily traffic jams, excessive noise as much as reduced traffic safety. The future development of public transportation in urban areas should give solution to traffic congestion in all respects. This research will present analysis of the existing traffic conditions in urban areas through the analysis of exhaust gas emissions, usage of traffic areas, traffic congestion as well as traffic noise, increase the level of traffic safety. As a result of this research: proposal of potential measures for reducing the harmful impact of public transport on the environment, its role as a generator and a key factor in reduction of traffic congestion in urban and highly urban areas.*

Keywords: *Public transportation, emissions, pollution, air, noise, congestion, safety.*

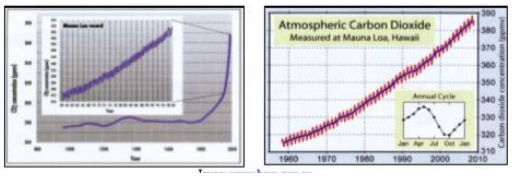
1. INTRODUCTION

Public transport is of paramount importance in the challenges that we encounter daily as inhabitants of urban areas. It is primarily meant to improve the quality of life in cities, by reducing traffic congestion, reducing travel time and lowering stress. As a positive example, we will teach US public transport lessons and save up to approximately 780 million hours in travel time and about 640 million gallons of fuel annually. Analyzing globally, on a global scale, assuming that no public transport funds are used, the costs of traffic jams would increase to around $ 50 billion.

Traffic development, in today's context, leads to physical congestion of traffic surfaces, environmental pollution (through emission of harmful gases and noise), a decrease in safety and a significant increase in costs (weather, energy and financial). It is justifiable to ask what kind of traffic we have in cities and how can we influence it?

As one of the largest and most important sources of air pollution, road traffic appears. Carbon dioxide (CO2) is released from the exhaust gases of motor vehicles, which leads to a gradual global warming (causing the so-called greenhouse effect, acid rain formation, damage to the upper layers of the atmosphere and other consequences).

Requests for improving the quality of life are being tightened, and in this respect, at the UN level, the Kyoto Protocol to the UN Framework Convention on Climate Change has been agreed. The Protocol is annexed to the international agreement on climate change and opened for signature on December 11, 1997, with the aim of reducing carbon dioxide emissions and other greenhouse gases. Experts estimate that by 2050 more than 6.2 billion people will live in cities. (about 2/3 of the world's population, which will then amount to about 9 billion). Urban population increases by about 50 million each year. Cities are getting bigger and so urban transport demands, which need to support the mobility of people and goods in cities, are increasing proportionately, and therefore environmental pollution from the JGP.



Source: www.bom.gov.au
Figure 1. A marked increase in CO2 concentration is visible in the second half of the twentieth century

2. DESTRUCTIONS IN URBAN ENVIRONMENTS AND REQUIREMENTS FOR THEIR REDUCTION

In order to carry out transport activities, regardless of whether it is a passenger car, public transport or logistics, it inevitably requires appropriate resources, such as: land, materials and energy, and in doing so produces unwanted side effects: atmospheric pollution, noise and starvation in traffic accidents.

2.1. Taking over the land

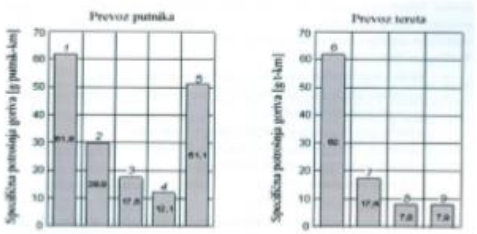
For the development of public transport, infrastructural surfaces are necessary. If the minimum needed surfaces are analyzed for the normal development of public urban transport, then it can be concluded that with regard to the take-up of the required land area for the railway transport infrastructure, considerably less land is required than road

transport. The smaller width of the land surface, which is occupied by the rail track, is important in the complex confrontation of the terrain, and is especially important in urban zones. The width of the 2-track light rail system with curbstones is 7.15 (m), and the total width along with a safety area of 2x0.7 (m) width is 7.75 (m). The necessary traffic areas, for the same volume of transport, with passenger cars are 42 to 48 times higher than rail systems for mass transport of passengers, which saves energy

consumption by 18 to 32 times and achieve a higher transport speed of 2.5 to 4 times, especially in the narrower city area.

2.2. Energy needs

If specific energy consumption is analyzed, rail transport for the same energy consumption as other means of transport can carry out the largest volume of transport.



Source: Passenger transport systems in cities

Figure 2. Specific energy consumption by different means of transport: 1. Passenger car in the city, 2. Passenger car on the highway, 3. Regular intercity train, 4. High speed train - TGV, 5. Avion, 6. Normal truck, 7.. Heavy duty truck, 8. Marsh train, 9. River freight transport

From Figure 2. it is visible that the energy efficiency of rail transport is 2 to 3 times higher than the automotive. Rail transport represents the best alternative to other modes of transport from the point of view of environmental protection by energy consumption.

2.3. Environmental pollution

The basic form of the negative impact of public urban transport on the environment is atmospheric pollution, the level of which is constantly increasing, due to a steady increase in automotive transportation, although by completing the design of internal combustion engines, the content of harmful substances in exhaust gases is reduced.

The data from 2005 tells us the amount of pollution caused by transport in the total amount of harmful substances in the atmosphere created by human activity: - 63% in nitrogen oxides (NOx). - 59% in carbon monoxide (CO), - 45% in hard particles, which has harmful effects on health, - 42% in floating organic non-metallic compounds, - 39% in carbon dioxide (CO2), which is the main cause greenhouse effects.

Also, if you are analyzing forms of public urban transport, the share of rail transport in harmful substances amounts to 0.1 to 0.8%, and the car is from 94 to 99%. From these data, it is possible to clearly notice the importance of using various forms of public urban transport in order to meet ecological factors.

Transportno sredstvo	Potrebe energije (MJ/pkm)	Specifična količina izbačenog CO_2 (g/pkm)
Prigradski dizel-voz	0,78	59,6
Prigradski elekto-voz	0,85	47,7
Metropoliten	1,1	61,6
Laki šinski sistem	1,0	56,2
Zglobni autobus	1,17	89,4
Autobus velike zapremine	1,06	80,8
Gradski autobus	1,37	104,3
Međugradski autobus	0,96	74,5

Source: Passenger transport systems in cities

Table 1. Amount of carbon dioxide (CO2)

Table 1 gives the comparative values of various rail and bus transport vehicles. For passenger cars the budget takes CO2 values of 278 (g / pkm) in the city and 210 (g / pkm) outside the city. This means that increasing the share of rail transport in public transport contributes to the solution of energy and environmental problems.

The main air pollutants emitted by motor vehicles are carbon monoxide (CO), nitrous oxide (NOX), various non-combustible carbon dioxide (CXHY), sulfur dioxide (SO2) and solid particles (carbonyl). In addition to these, motor vehicles emit a series of highly toxic components: benzene, formaldehyde, polynuclear aromatic carbohydrates, lead whose emissions are associated with fuel quality and fuel additives.

The noise caused by the movement of vehicles in the city also leads to the psychological and physiological disturbances of the inhabitants. Some types of vehicles broadcast the following noise:

	dB (A) Srednja vrijednost	dB (A) granica
Putničko vozilo (1100 ccm)	70	67-75
Putničko vozilo preko 1600 (ccm)	72	68-77
Dostavno vozilo	73	69-77
Teretno vozilo i autobus	81	76-86
Motocikl	77	72-86
Tramvaj-stara konstrukcija	81	76-86
Tramvaj-nova konstrukcija	75	73-77
Podzemna željeznica	75	73-77

Source: Passenger transport systems in cities
Table 2. Types of vehicle and noise emission

The table above shows that a freight vehicle or a bus develops, under certain urban traffic conditions, as much noise as 10 passenger cars and that the passenger car causes 10 dB (A) less noise than a freight vehicle or bus. However, it is necessary to make a certain difference between freight vehicles and buses, because buses are usually quieter. Compared with a passenger car, it should be noted that the bus, in terms of its capacity, or the number of passengers it transports, replaces 30-40 passenger cars, giving it a relative advantage in general traffic compared to passenger cars, but which does not necessarily exclude the need to the noise produced by the bus does not decrease to a tolerable extent.

Special progress has been made in the modern construction of trams, where it is suited to the solution of the main sources of noise (reducer, compressor, vibrations of rotary masses, etc.) it is minimized.

The gas engine in relation to the petrol engine emits:
- up to 80% less carbon monoxide (CO), especially in idle.
- up to 50% less lung oxide (NOx).
- up to 50% less indelible hydrocarbons (CH).
- almost all compounds in the oil and gas exhaust are carcinogenic.
- no exhaust gas compound is cancerous.

There is no exhaust gas in the gas:
- lead compounds;
- benzole;
- sulfur dioxide;
- aldehyde;
- and there are very few particles in the soot.

2.4. Transportation security

In the analysis of various environmental impacts, the aspect of transport safety is particularly important, because in transport, the preservation of people's lives and health is very important. In relation to the volume of transport for each type of transport, the indicators of mortality of air and rail transport are approximately the same (0.25 and 0.18 killed per 1 billion passenger / km). It is about 75 times less than in car transport (15 killed per 1 billion passenger / km). An effective policy in the field of security is considered as an important factor in the conduct of public transport policy, which gives priority to the development of rail transport.

3. MEASURES FOR REDUCING THE NEGATIVE INFLUENCE OF PUBLIC TRANSPORT OF THE PUBLIC TRANSPORT IN THE ENVIRONMENT

The guidelines of the "pure public transport" concept in the EU countries are as follows:

1. Further evolution of EURO regulations regarding emissions of exhaust gases (with the trend of reducing the maximum engine emission value in (gr / kWh));
2. Use of diesel fuel in accordance with Directive 2003/17 / EC regulating the quality of diesel fuel, in particular the maximum sulfur level; 3. Application of SCRT (Selective Catalytic Reduction Trap) technology for buses with EURO 2 and EURO 3 engines in order to reduce the emission of nitrous oxide (NOx) and particles;
4. Use of buses on natural gas CNG, LPG;
5. Use of renewable biofuels (Biodiesel, ethanol, biogas);
6. Use of diesel-electric "hybrid vehicles";
7. Rehabilitation of trams and trolleybuses;
8. Application of hydrogen fuel technology (Fuel Cell).

As a first step, it is desirable that all bus operators, in cooperation with the

competent local authorities, define the future strategy for introduction into the exploitation of environmentally friendly vehicles.

When defining the strategic plans for the development of public bus operators in cooperation with the competent local government bodies in the City of Sarajevo but also in other major cities in BiH, where public transport is developed, taking into account the fact that Bosnia and Herzegovina will become a member of the EU in the forthcoming period, account must be taken of the following:

- Further development and modernization of electro subsystems of public urban passenger transport (trams and trolleybuses);
- Used vehicles with conventional low-emission gas emissions
- EURO 4 and EURO 5 standard, and in the perspective of introduction of EEV standards with even lower pollution emissions;
- Introduction into the exploitation of buses with hybrid drive, ie diesel-electric drive.
- Introduction to the operation of buses using alternative fuels such as compressed natural gas (CNG or LPG), biodiesel.
- Harmonization of standards and regulations in the field of emissions of harmful gases with the EU;
- Amendments to the legislation and by-law in the sense of a more severe sanctioning of the owner of vehicles whose vehicles do not meet the requirements in terms of maximum emission values of harmful combustion components;
- Introduction of an inspection program for the emission of harmful components of combustion (in different places on the vehicle: emission control on exhaust, control of emissions of fuel volatility, etc.);
- Determination of the effect of the traffic light cycle on the fuel consumption of public urban transport and, in this respect, the development of corrective measures on traffic lights;
- Control emission of harmful components of combustion through reduction of traffic density, ie stimulation of citizens to use the means of public urban transport.

In order to reduce unacceptable noise levels in Canton Sarajevo, the following activities should be carried out:

- Amend and amend the legislation and by-law on the sanctioning of excessive noise;
- Activate the noise measurement equipment, "the phonometer, owned by the traffic police, and control the roads, and the owners of cars that produce excessive noise values will be sanctioned; - Construction of roads that will be designed to provide maximum possible protection against noise for nearby residential buildings.

As guidelines for the drafting of legal noise legislation in the Canton Sarajevo, account must be taken of:

- Rules on protection from traffic noise at federal and state level,
- Methodology for calculation of noise on roads and railways,
- Determination of the noise limit value on roads and railways,
- Guidelines for protection against road noise,
- Noise calculation methodology in parking spaces,
- Sizing the noise protection device.

It is necessary to periodically measure emissions of harmful components of combustion as well as noise levels, to analyze the obtained data, to compare with the defined standards and values measured in the previous period and to take appropriate actions in order to improve the situation.

4. CONCLUSIONS

Ecologically clean public transport system is an imperative for the sustainable development of the European Union's security forces. Observing legislation and available options for using alternative fuels in EU countries, it is necessary to actualize and initiate this issue within Bosnia and Herzegovina as well.

The experience of public transport companies and local governments of the EU cities related to sustainable

development is a roadmap for finding solutions that will make the public transport system in Sarajevo a promoter of sustainable urban development. The ultimate goal is to connect Sarajevo with a green map of Europe.

The current state of the economy of Europe, especially the bad state of affairs in BiH, should not create pessimism in terms of the large financial needs of investing in the public transport system. Procurement and introduction into the operation of buses with ecologically clean SUS engines should be gradually with a trend of acceleration of the dynamics of procurement of new buses that would replace buses with conventional fueled engines. Also, efforts should be directed at purchasing a modern tram (low-floor) vehicle fleet.

Developing awareness of ecologically clean public transport, harmonization of domestic standards and regulations with the EU, procurement of ecological "clean-buses" with the aim of reducing emissions of harmful combustion components, a new tram fleet, must be an imperative and an integral part of all strategic plans of public auto transporting companies in Sarajevo, the Ministry of Transport and Communications of the Canton Sarajevo, as well as other local government bodies, that is, municipal and city authorities.

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