

## ENVIRONMENTAL IMPACT ANALYSIS OF THE PUBLIC TRANSPORT SYSTEM IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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**Abstract:** *Environmental protection is one of the first priorities in the activity of various political courts, be they national, European or global. All these organizations have set goals to limit the negative effects on the environment and to prevent their occurrence in the future. Measures to reduce noise pollution require investments, new materials, new techniques in civil and industrial construction, in machine building, rethinking processes, installations, means and traffic systems and last but not least, a civilized behavior of people among themselves. Therefore, the local community has a great role in combating noise pollution as well as other forms of pollution. It is necessary to find solutions and measures that allow for sustained action both nationally and locally by the competent authorities, in order to reduce the level of pollution due to road traffic, and to provide clean air to the inhabitants of these cities. This objective also supports the preparation of the integration of the Romanian transport system in the transport systems of the European Union, as a basic condition of our country's accession to the EU. The objective of the present research is represented by the study of the negative effects of the transport activity on the natural environment and on the society, by reviewing the existing literature, as well as by carrying out an analysis based on statistical data.*

**Key words:** *environment, pollution, transport, sustainability*

**JEL CLASSIFICATION:** O18; Q56

### 1. Introduction

People have always traveled, initially over shorter distances and for food, then over longer distances to conquer new territories or to progress (Kim & Chae, 2016). Thus, the modes of travel have evolved, from walking, to bicycle, train, carts that used animal traction, to cars, high-speed trains or means of air transport.

Travel is of major importance in people's lives, especially when they live in a big city, either through their own means or through the public passenger transport service (Badea, 2004). This is also the reason why the impact of public transport in large cities on the environment will be presented and what pollution reduction projects exist for the area in question (Bran et al., 2018).

Thus, the regular passenger transport service is defined as the service that ensures the transport of persons, according to the traffic schedules, on specified routes, in which the boarding/disembarking of persons transported in/from the vehicle is done in pre-established stopping points; the regular passenger transport service implies the obligation to respect the traffic schedules, this being accessible to any person (Burlacu, 2018).

The special regular passenger transport service is a public passenger transport service performed at the request of a beneficiary, which ensures only the transport of certain categories of persons, insofar as this service is carried out in compliance with traffic schedules, on specified routes, in which the boarding / disembarking of persons transported in / from the vehicle is done at pre-established stopping points, other than public stations (Litra & Burlacu, 2014).

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Road transport is by far the most dangerous source of emissions, with a share of 94% in the amount of greenhouse gases released into the atmosphere (Al-Mansour et al., 2019). Neither of the two components, passenger and freight, has proven to be generous to the environment (Burlacu & Stoica, 2012). Both emitted more and more greenhouse gases (Burlacu et al., 2013).

## 2. The effects of road traffic on the environment

The sources of air pollution of anthropogenic nature are (Georgescu, 2007):

- industrial sources - inorganic products factories; organic products factories; paper and pulp mills; food industry; thermal power plants; cement factories and building materials; steel plants; non-ferrous metallurgy plants;
- means of transport - vehicles; locomotives; naves; airplanes;
- domestic sources - block crematoria, neighborhood, city; individual and collective heating systems (see figure 1).

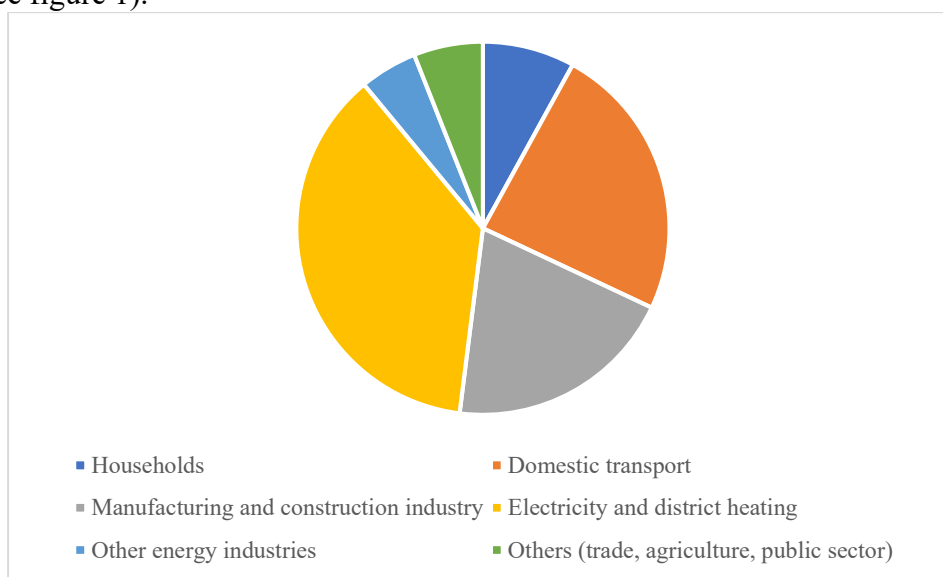


Figure 1- The structure of carbon dioxide emissions, international, 2019

### 2.1. The impact of urban transport on the environment

The impact on the environment is defined as the influence, even the aggression produced on the environment (Kenai, 2018) the influence produced as a result of the conscious action of man, with or without the conscious perception of all the effects of this action. If human actions take place without conscious perception of their effects, aggression reverberates in time and space, and can have irreversible effects (Burlacu & Stoica, 2012).

The impact of roads on the environment is the influence or even aggression produced by the execution (Brakenhoff L., et al., 2020) maintenance and operation of roads on the environment, the influence produced as a result of conscious human action (road builders and administrators, users), with or without conscious perception of all effects (Bran et al., 2018).

With the accelerated development of transport and especially of car production in the last two decades (comparable only to computers), the balance of major sources of toxic substances has changed its inclination, transport becoming the main source of environmental aggression and human health (Faggianelli et al., 2018).

It was concluded that the transport activity is the cause of many negative effects felt both at the global level of society (environmental damage, destruction of natural ecosystems, habitat degradation) and at the individual level. The quality of life and especially the health of people around the transport networks is thus severely affected (Profiroiu et al., 2020).

Recent measurements and research have shown that transportation is the fifth major factor contributing to accelerating the global warming effect, accounting for 11% of all pollution sources (see Figure 2) and being responsible for about 35% of total carbon dioxide emissions. In particular, road transport contributes the most to this situation, being a major cause of air pollution, especially in crowded centers.

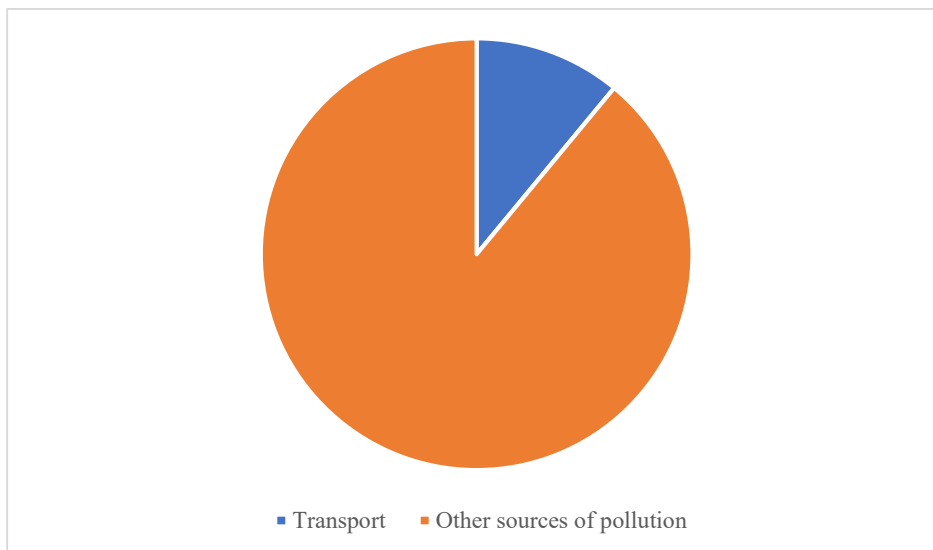


Figure 2- The contribution of transport to accelerating the heating effect

## 2.2. Atmospheric pollution caused by road traffic

The atmosphere is considered the largest vector of pollution propagation, the pollutants discharged in it affecting directly and indirectly, at short and long distances, both the human element and all other components of the natural and artificial environment (built) (Bran et al., 2020).

Atmospheric pollution caused by road traffic is one of the major factors affecting the health and living conditions of the population in large urban areas (Alpopi et al., 2018). Discomfort caused by exhaust fumes, reduced visibility, negative effects on human health and vegetation caused by dust and harmful gases, damage to buildings due to dust and corrosive gases, acid rain are among the major environmental problems of urban areas (Bodislav et al., 2019).

Motor vehicles emit both gaseous and solid pollutants (particles) into the atmosphere, the most important of which are carbon monoxide, nitrogen and sulfur oxides, volatile hydrocarbons and lead compounds. In the center of large urban agglomerations, road traffic is responsible for about 90-95% of the concentrations of carbon monoxide and lead found in the air, for 60-70% of the concentrations of toxins and unburned hydrocarbons and for a significant percentage of suspended particles .

A German study found that abnormal lung function, wheezing and acne in school children were directly related to the volume of traffic in the neighborhoods where these children lived or where the school was located.

It should be noted that the problem of air pollution is complex and that the detailed composition of polluted air varies greatly depending on the geographical area, the geometric configuration of polluting sources, temperature, humidity, light intensity, etc (Negescu Oancea, et al., 2020).

The means of transport represent an important and very diversified category of indispensable accessories of the civilization and at the same time, they produce producers of the pollution of the natural factors (Dănciulescu, 2008). Airplanes, in turn, consume high quality gasoline, which leads to the elimination of less polluting products. However, the negative effect is

amplified by the fact that the flight of planes at higher and higher altitudes injects pollutants into the upper layers of the atmosphere, directly into the protective layers of CO<sub>2</sub> and ozone, with negative consequences on them (Pan et al., 2018).

### *2.3. Solutions to minimize the negative effects of road pollution*

It was estimated, based on forecast calculations, that in the coming years road transport will double the number of cars in circulation, reaching saturation if no restrictive measures are taken (Dima et al., 2020).

Gasoline taxes in European Union countries have reduced emissions of polluting gases. There is a consensus in the transport sector that its operation is not sustainable. The way in which our society has organized the transport of passengers and goods is partly unfair socially, economically and in terms of environmental impact. There is also a consensus on the fundamental principles of sustainable transport, such as the internalisation of externalities, the "user pays" principle, fair competition between different modes of transport; but this consensus does not go beyond that.

A reduction in transport leads to increased economic efficiency and production (Bianchini A, et al., 2019). It stimulates a more efficient use of resources and increases economic productivity in areas that have suffered due to an unbalanced distribution of values due to spatial concentration and centralization processes (Negescu Oancea, et al., 2019).

Sustainability is based on three pillars- economic, social and environmental . Social problems related to transport are often unclear or not taken into account and the social / psychological factors that support transport models are often ignored. Sustainable transport systems increase social cohesion, reduce environmental problems and help create a more efficient economy and increase the quality of life. Transport is an important factor in socio-economic development, but if it is not developed sustainably it imposes significant costs on society in terms of environmental and health impact (Profiroiu et al., 2020).

Emissions of pollutants such as nitrogen oxides, hydrocarbons, carbon monoxide, dust cause or exacerbate a number of health problems (Rajput, S., Singh, S.P., 2019). The impact on health attributed to trafficking includes a higher incidence of cancer and heart disease, respiratory problems and their severity. Technological improvements, which have reduced emissions, have been offset by an increase in traffic, so that emissions are still rising. Cars are the main source of air pollution in urban areas at European level.

At the level of the European Union, about 28% of greenhouse gas emissions are due to transport, 84% of these emissions coming from road transport. More than 10% of carbon dioxide emissions in the EU come from road traffic in urban areas (Burlacu et al., 2020).

Municipalities can adopt transport management strategies that promote alternatives to car use, reducing the number of cars in traffic will dramatically reduce pollution and noise levels (Radulescu et al., 2020).

Charging for the use of infrastructure, environmental charges or traffic congestion would do much to reduce the negative impact of transport on health (Veum & Bauknecht, 2019). The London charging system introduced to eliminate traffic congestion provides evidence that the implementation of charging systems is politically possible.

For example, in Germany, a gain of about 300,000 jobs is expected if there is a shift to sustainable mobility with less impact on the environment. Simple strategies can help reduce the damage caused by transportation to human health: even the rigorous implementation of speed limits and parking regulations can lead to emission limitations, increased safety and increased demand for public transport in many cities (Bodislav et al., 2020).

Increasing the combustion temperature inside the engines has led to increased efficiency and reduced CO<sub>2</sub> emissions (Navarro, 2021). The use of diesel engines eliminates a number of

disadvantages of gasoline engines, being more efficient, but generates new problems related to the emission of polluting gases.

#### 2.4. *The level of polluting emissions of biodiesel fuel*

Biodiesel fuel is the first and only alternative fuel that has a complete assessment of the pollutant emissions produced by its combustion in car engine (Maggi, F., et al., 2020). The United States Environmental Protection Agency (EPA) has assessed the health effects of diesel biofuel combustion in its section on air purity. In this regard, a series of programs have been carried out in the last 2 years regarding the most stringent testing protocols required by the EPA for the certification of fuels and / or additives. A complete inventory of the opinions gathered by the major engine manufacturers regarding the use of diesel biofuel has been made. Also, laboratory tests were performed that highlighted the level of pollutant emissions

Analyzing the data shows that the potential for alteration of the ozone layer by smog formation is lower in the case of diesel biofuels (B 100 and B20) than in the case of conventional diesel fuel, by approx. 50%, by decreasing the nitrates of polycyclic aromatic hydrocarbons. Sulfur emissions are completely eliminated by the use of B 100. Pollutant emissions from exhaust gases no longer contain sulfur oxides or sulphates (important components of acid rain), because sulfur is no longer found in the molecular structure, in the case of B 100 compared to diesel.

While in recent decades, the rest of the world from Europe and Asia to the Americas, has developed a concerted and serious research and implementation of projects for biofuels, seen as an increasingly likely and imminent alternative to traditional fuels, Romanian society tries to initiate such research.

The few organizations working on environmental issues focus more on solutions to heal the polluting industries sector, none of which have concerns about combustion-induced pollution, although recently, in terms of the danger of environmental damage, the transport sector had to take clear responsibility before the European Commission, given that, in the last 15 years, it has contributed substantially to increasing global warming, exceeding in this respect the industrial and domestic sector, 75% of acid pollution being the result of engine emissions.

While in the world the big producers and distributors of fuels, but also producers of diesel engines, have invested in the last decade considerable sums and an appreciable effort of inventiveness, both for the production of biofuels themselves and for the profitability of this sector, the main Romanian operators in the field are trying to initiate such attempts.

*Table 1- Comparative analysis of flue gases in biodiesel and petrodiesel*

Noxa issued (%)	Diesel	Diesel + biodiesel 80%+20%	Biodiesel 100%
CO <sub>2</sub>	100	84	22
CO	100	80	50
Aldehydes	100	<100	70
Hydrocarbs	100	70	15
Aromatics	100	85	50
Solid particles	100	78	70
Sulfur oxides	100	83	-
Nitrogen oxides	100	90-102	80-108



### 3. Conclusion

Sustainable transport systems have a beneficial contribution to the social, economic and ecological sustainability of the communities they serve. Conventional transportation systems have a significant impact on the environment, contributing about 30% to global energy consumption and carbon dioxide emissions. Greenhouse gas emissions from transport are growing much faster than in any other sector.

Improving the quality of urban life can be achieved by implementing a Sustainable Urban Mobility Plan, which in many cases would require a serious rethinking of urban planning. A city must be built for people and it should be a place where it is pleasant and safe to walk to shops, parks and schools, where the streets can be crossed safely and allow cycling and even children to play. safe, where the service is not very far away or can be easily reached by bus or tram, where buses move quickly on special bus lanes and have priority at traffic lights.

The road transport activity has an intense and diversified impact on the environment. The ecological impact is manifested both due to noise, air, water and soil pollution, and due to the consumption of energy and natural resources, the road infrastructure being built by using large quantities of materials, many of them being energy intensive.

The diminution of the impact on the environment is obtained, first of all, by carrying out the activity corresponding to the specifications from the authorizations and operating permits, provided by the normative acts in force. Authorizations and permits include the environmental permit, the water management permit, the sanitary operation permit, the fire prevention and extinguishing permit, the intervention plan in case of calamities, etc.

Early identification of possible exceedances of the limits provided in the technical norms and legislative acts is done by implementing a program for monitoring environmental factors.

The branch of road transport, through the activity of execution and operation, both of the infrastructure - represented by the road transport network, and of the superstructure - represented by the means of road transport, can contribute to the attenuation of the multiple impacts it produces on the environment. However, this involves knowledge and understanding, but also political will and financial resources.

In the current period, the reduction or elimination of the impact on the environment is the major problem of humanity. Environmental protection measures, necessary as a result of carrying out various activities with an impact on it, are at the center of the world's concerns.

The road transport infrastructure represents, through the magnitude and diversity of impacts, one of the main pollutants. For this reason, the issue of environmental protection is necessary to be included in all construction stages, respectively in the design, execution, maintenance and operation of road infrastructure.

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