Urban and transportation planning for continuing decreasing air pollution in a small town

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Abstract

Experts (engineers and city planners) of departments responsible for traffic studies and urban development across the country are particularly focused on to two major problems, which are interconnected, respectively on traffic congestion and air pollution. Between the two problems, traffic congestion is more difficult to resolve because improved technologies for building vehicles already take into account the importance of air quality.

Introduction

The forecasting of traffic intensities and counting the green zone areas are necessary tools to analyze present and future traffic needs and determine investment decision-making notably and answer questions concerning the effects on the environment, safety, operation costs of roads, etc.

Pantelimon town is located east from Bucharest, at short distance. Pantelimon town covers an area of nearly 135 square kilometers and has a stable population of 18.898 inhabitants, of which 9253 are men and 9645 are women. The town is crossed by two county roads (DJ 100 A, DJ 301) and a national road (DN 3), road leading to Black Sea.

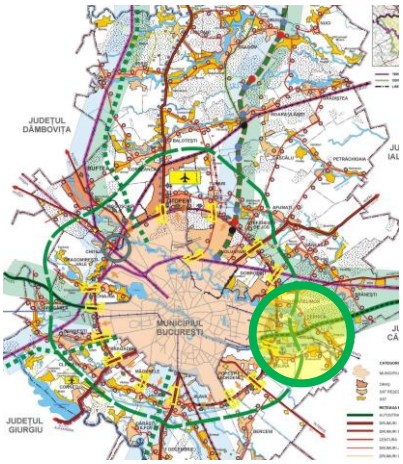


Figure 1: The map of the Pantelimon town in relation to the city of Bucharest

Location of Pantelimon town can be considered a metropolitan area of Bucharest because it includes not only the urban area, but also satellite cities plus intervening rural land that is socio-economically connected to the city.

The law 104/2011 concerning ambient air quality, which implements the regulation 2008/50/EC of the European Parliament and of the European Council on ambient air quality and cleaner air for Europe, is the governing law when conducting ambient air quality evaluations.

The considered air pollutants in evaluating ambient air quality are:

- sulphur dioxide (SO2)
- nitrogen dioxide (NO2)
- nitrogen oxides (NOx)
- suspended particulate matter (PM10 and PM2, 5)
- lead (Pb)

- benzene (C6H6)
- carbon monoxide (CO)
- ozone (O3)
- arsenic (As)
- cadmium (Cd)
- nickel (Ni)
- polycyclic aromatic hydrocarbons / Benzo (a) pyrene (BaP)
- mercury (Hg)

Pantelimon town has been formed in an area without a functional infrastructure to support it town life. As long as the population of an urbanized area grows, the city's infrastructure must grow with it, or else shortages will develop, typically in housing, education, transportation, clean water and waste removal services, or other services such as law enforcement.

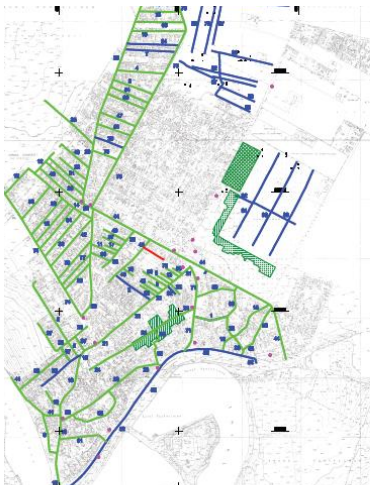


Figure 2: Road network and the location of individual components of the Integrated Project for Pantelimon town

This paper describes few steps in achieving an urban and regional development strategy, starting from the analysis of existing infrastructure. It will monitor the traffic that connects arteries, such as road intersections or major street network. It will analyze how traffic connections are made, given by the need of regional integration and taking into account European standards.

The urban and traffic interventions have the ultimate goal for continuing decreasing air pollution in a small town like Pantelimon town.

The impact of road transport on the environment

Transports play an essential function for the socio-economic development of a region or country. The transport not only provides access to jobs or leisure, housing, goods and services to residents, but it also facilitates relations between countries.

Among all transport types in Romania I will refer to the road transport only, since it has the greatest impact on the environment.

The impact of this type of transport on the environment is highlighted on the level of all environmental factors through:

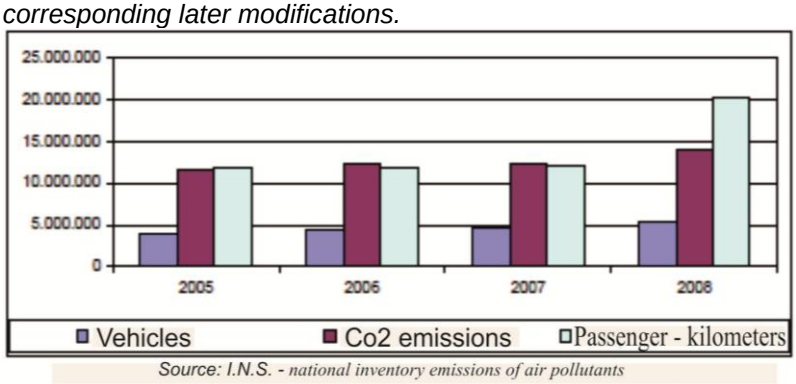
- traffic congestion and accidents;
- air pollution, as a result of emissions;
- noise and vibrations – at the major intersections along roads, near transport nodes
- soil and water pollution;
- occupation of land in urban areas for parking areas;
- changing eco-urban landscape;
- production of solid waste (tires, accumulators etc.).

One of the most significant consequences that transportation has on human health, is connected to harmful exhaust gases containing NOx, CO, SO2, CO2, volatile organic compounds, heavy metal particles (lead, cadmium, copper, chromium, nickel, selenium, zinc), pollutants combined with particles generated from the road. All these can cause acute and chronic respiratory problems or might even worsen other diseases. Heavy traffic generates high levels of noise and vibrations, which causes stress conditions, sometimes with major implications on health.

In terms of environmental impact, there is a wide range of factors that influence the increase of CO2 emissions resulted from road transport, such as supply and demand for cars, individual mobility needs, availability / non-availability of alternative public transport services and associated costs of a personal car.

In Romania, transport policy aims to align ongoing national transport system to EU transport policy principles set out in the White Paper-Roadmap to a Single European Transport Area (with corresponding updates) and to the requirements of sustainable development of Romania.

In its quality as an effective member of the EU since 1st January 2007, Romania has pursued implementation of the applicable provisions of the European Parliament´s and European Council´s Decision no. 1.692/1996/EC of 23 July 1996 on the European Community guidelines for the development of trans-European transport network, as amended by Decision no. 1.346/2001, and of the future TEN-T network on its territory defined by *Law no. 203/2003 on the realization, development and modernization of national and European transport, with the corresponding later modifications.*



Source: I.N.S. - national inventory emissions of air pollutants

Figure 3: CO2 emission trends depending on the vehicles fleet and the number of passengers - kilometric

In this context I should mentioned some of the mid-term priorities set by the Romanian Governance Programme 2009 - 2012 and by other public policy documents and institutional commitments (sectorial strategies, national development plans as well as other development programs):

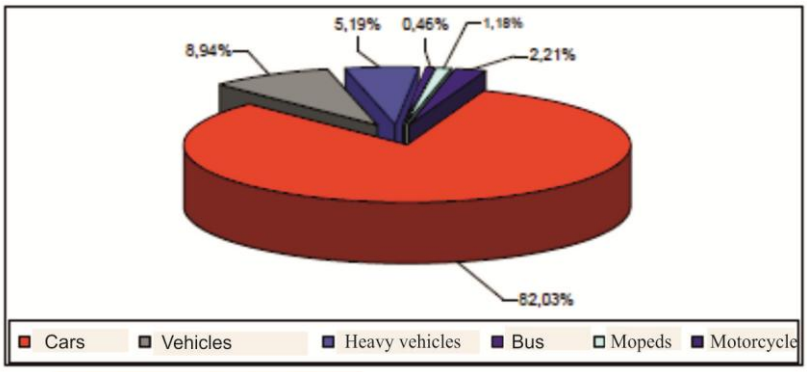
- modernization and development of transport infrastructure in order to improve service and environmental quality, traffic safety and security as well as to ensure interoperability of the transport system
- strengthening of social and territorial cohesion at national and regional level by providing connections between cities and increasing population´s accessibility to the public transportation, including areas with low population density and / or dispersed centers
- increasing competitiveness in the transportation sector and the liberalization of the domestic transportation market
- improving transport behaviour in relation to the environment, reducing the global impacts of the transport (climate change) and reduce degradation of environmental quality in natural and urban environment.

Road transport – statistical data

According to data of Romanian (Auto) Vehicle Registry in 2009, the vehicles fleet was counting 5.785.575 vehicles, 8% more than in 2008. The vehicles fleet includes cars, light heavy vehicles, buses, mopeds, motorcycles. Compared percentage is represented in Figure 2.

During 2002 - 2008, the total length of roads increased from 78,896 km to 81,693 km in 2008, meaning a growth of 800 km (about 1%) than in 2007 (Fig. 3). Within the total length of public roads in 2008, the part of modernized road length represented 28%, meaning an increase of 3% compared to 2002.

Considering the regional development, Region 1 North - East has the highest length of public roads whereas the Region 8 Bucharest - Ilfov, has the lowest value of the length of public roads, a situation highlighted in Figure 4.



Source: Romanian Auto Registry

Figure 4: Vehicles fleet structure in 2009

The highest density of roads per 100 km2 territory is set down in Region 8 Bucharest - Ilfov (48.9) and the lowest density is set down in Region 2 South - East (30.7), the national average being 34.3 In Romania there are only 211 km of highway, of which 193.1 km start/ finish in Bucharest:

- A1 Bucureşti-Piteşti, 95,8 km.
- A2 Bucureşti-Drajna, 97,3 km.
- A2 Feteşti-Cernavodă 17,5 km

The ring road around the capital is not full released yet, situation that affects the level of traffic congestion and its related consequences (such as longer drive time, higher levels of pollution and energy consumption) in Bucharest urban area.

In addition to the above – mentioned road ring is the problem of car parking areas, which are not enough developed, both in the urban area of Bucharest and Ilfov county and in the vicinity of the many gateways to the city.

In 2004, the streets of Bucharest Municipality had a total of 1821 km length, hence 839 km - meaning 46% - were modernized. The streets in Ilfov County had 132 km length, of which 65.15% were modernized.

The total road length and their rate of modernization in the capital region keep to be inadequate for a European capital region and does not ensure the necessary conditions for optimal traffic: in 2003 the total length of roads per 1000 inhabitants (residents) was only 0.99 km. in Bucharest City, 3.29 km. in Ilfov County, less than the Romanian average - 4.71 km. per 1,000 inhabitants. The report didn´t take into account the daily flow of commuters (over 400,000).

BYPASS ROADS ALTERNATIVES

National Transport Strategy

The connection intercity - city transportation is essential for achieving sustainable transport. A great part of the demand but also of the negative effects of transportation is concentrated in the cities. Goals such as improving efficiency and quality of transport services, strengthening social and territorial cohesion, reducing greenhouse gas emissions can be achieved only if a proactive strategy in the urban areas it´s adopted.

The construction of 1,767.3 km of highway (in operation at the end of 2013) and of about 850 km of bypass roads around the urban areas are part of the national strategy of transport modernization in Romania.

In order to ensure the traffic fluidity, eliminate traffic jams and secure the transit through localities, a bypass road alternatives program was established. It includes 10 bypass road alternatives (166 km) highway profile and 40 bypass road alternatives (698, 9 km) of national road profile.

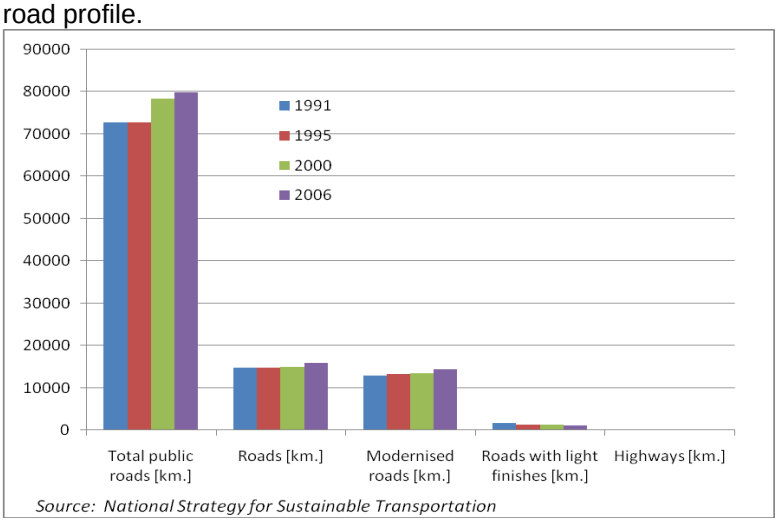


Figure 5: Road network characteristics

Considerations regarding the current situation on the transport- environmental factors relation

Air

The road transport impact on the air quality has increased because of the growing number of private owned and new public vehicles and also due to the increased mobility of passengers and goods, both in the national and international transport area. The most significant emissions produced by the transport sector are: nitrogen oxides, sulphur oxides, suspended particulate matter (PM), VOCs and heavy metals (eg lead). The air pollution in Romania´s cities is largely due to transport, but there is no data to make a comparison between pollution caused by private transport and public transport or other means of transportation could causing pollution.

Water

Transportation is not the main factor contributing to the water pollution, though it affects surface water quality and indirectly groundwater due to soil pollution.

Soil

Soil pollution generated in the transport sector is largely caused by air emissions through direct discharges (oil, fuel and chemicals) and leakage on road surfaces that are then washed by rain. Soil pollution in Romania that it is caused by traffic occurs generally only locally, and it appears through the indirect effect on the quality of surface water and groundwater. Anti-freeze substances used in winter roadway surfaces are also a potential source of pollution.

Climate changes

According of the 3rd National Communication concerning the candidate country, in 2001, 11% of greenhouse gases emissions in Romania were due to the transport sector. The total net emissions of greenhouse gases fell by about 50% in 2002 compared to the reference year 1989. This decrease was mainly due to significant decrease of industrial production (by lowering energy consumption and closing some old industry branches) and economic restructuring in transition to the free market economy, but not due to specific measures and policies to reduce emissions. Contrary to the achieved reduction of greenhouse gases emissions generated by the

industry, stands the increasing share of greenhouse gas emissions produced by the transport sector, a tendency noted also in the EEA TERM report 2005 Report (No.3/2006).

«Natura» Ecological Network 2000

In Romania has 5 of the 11 European bio-geographical regions, which is the largest number of biogeographical regions owned by a single EU country. «Natura 2000» is still in the process of development and should be completed by the end of this year. 190 SPA (Special Protection Avifaunistical areas) has been identified, representing approximately 27% of Romania's territory, and also other 370 SCI (Sites of Communitary Importance), representing approximately 14% of the Romanian territory. There are areas where anthropogenic activities have had negative effects on wildlife conservation. Constructions of roads and transport corridors have a direct and usually irreversible impact on ecosystems and biodiversity. At this time, Romania has one of the lowest levels of fragmentation of habitats, which represents a great when it comes to nature conservation.

Nature and cultural heritage

Transportation and transport infrastructure have a direct impact on the natural landscape of the country. The construction of highways is a desiderable goal for Romania, and this changes the natural landscape rapidly. Land is under continuous pressure resulted from the new transport infrastructure. Roads are the largest consumer of land, followed by railways.

Transport and environment users

Responsible behavior towards the environment experienced by transport users suffered heavily due to lack of investment in public transport system and due to its development´s neglection in Romania of the last decade. Transport users turned to purchase/ use personal cars, so they increased investments in this area. This practice has increased with the recent evolution of economic development. Alternative means of transport such as cycling and walking, were not promoted in Romania, thus damaging environmental factors (especially increasing air pollution in urban areas) disadvantaged a sustained support in promoting such measures.

In addition, there is no easy access for the elderly or disabled to public transport because the appropriate infrastructure is generally missing. So far, few measures have been taken to promote and raise awareness regarding environmental responsibility in connection with transportation.

Conclusions

Building bypass highways, it will bring further advantages, in addition to those already mentioned above, such as diminishing the negative environmental impact through drastically pollutant emissions reduction in accordance with the transport policies applied by the European Union.

The construction of highways and ring roads has an essential contribution not only to the traffic safety, decreasing of traffic disruptions within cities, but they also have a huge impact on the environment by reducing pollution in the cities.

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