Urban Policy Group

Final Research Paper

New urban transportation policies in Serbia as a factor of sustainable development

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C O N T E N T S

1. INTRODUCTION

Growing volumes of traffic have been identified as a main reason for air pollution, which is causing a wide range of environmental, social and economic problems in European towns and cities. Considering that the mobility is a vital part of our lives, this problems will be further aggravated in the future. All the forecasts assume continuing growth of traffic. Relying solely on technical approaches is not a solution to these growing problems; it is also necessary to develop new ways of communication and partnerships to achieve behavioral changes in the daily mobility patterns of European citizens by supporting usage of alternative and environmentally sound modes of transport, raising awareness of the environmental impact of the mode of transport chosen, addressing social acceptability of changing mobility systems.

In 1995, based on the commitment overtaken at the Aalborg conference, officials of the Dutch city of Hague decided to prepare a local agenda following the model for sustainable development. A section of the local agenda contains a definition of transportation goals. The traffic was acknowledged as an expensive and environmentally inadequate function of the city. The task was to decrease irrational use of cars through improved public transport, quality and safe bicycle and walking infrastructure, car-pooling system (multiple passengers), ect.

These measures were transformed into new urban policies and have been adopted by the rest of Europe.

At present, the main contributor to growing air and noise pollution in CEE countries is increasing preference for private car use. In major towns and cities in CEE, increased private car use contributes to environmental damage, misuse of urban space and potential health hazards.

Nevertheless, in Central and Eastern Europe, private cars symbolize not only individual means of transport but, even more intensely, after the radical political changes, a way to move around freely and unhindered, thus becoming the symbol of freedom and prosperity. Many individuals still dream of owning the car, making its status even higher than in western European societies. However, in Central and Eastern Europe, the situation is even more difficult as the development what kind of development – economic, social, political has taken place over a relatively short period of the past ten years, thus putting the relatively new and inexperienced governments into a difficult position to resolve immense problems, including those related to transportation and traffic.

Despite its difficulties, some CEE countries have succeeded in using the transition period to establish more livable conditions for its citizens in urban and rural areas. Serbia, shattered by the state of deep crisis is not among them. The crisis with its economic, ethic, ecological and wider social dimensions had a devastating impact on both urban and rural citizens. For the time being, principles of sustainable development in Serbia have been recognized only formally, except for the theoretical interest of a part of town planning experts.

This project is separated in two major parts.

First part refers to theory and practice related to transportation for the sustainable development of cities in EU counties and gives overview of methods and policies applied in western European cities.

Second part is refers to urban transport situation is Serbian towns. Five different tows were selected for case studies. Towns are chosen to cover different sizes and characteristics of towns in Serbia.

After analysis of urban transport situation in Serbian towns and comparative analysis of Serbia and other countries were developed recommendations applicable to the Serbian environment and dynamics of their implementation.

Outcome of project is policy paper primarily intended to Local Governments in Serbian cities. It contains number of different measures related to parking management, public transport and safer travel for pedestrians and cyclist.

2. TOWARD SUSTAINABILITY

In developing its approach to urban sustainability, the Expert Group endorses the following well-accepted definition of sustainable development presented in the Brundtland Report, World Commission on Environment and Development, 1987:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development is thus a much broader concept than environmental protection. It implies a concern for future generations and for the health and integrity of the environment in the long run. It supports concern for maintaining the quality of life (not only the income growth), for equity among people of today (including the prevention of poverty), for inter-generation equity (people in the future deserve an environment which would at the least be as good as the one we currently enjoy), and for the social and ethical dimensions of human welfare. It also implies that further development should only take place as long as it is within the carrying capacity of natural systems. Evidently, addressing the sustainable development agenda provides new challenges for urban policy integration within holistic frameworks.

The following more practical and local interpretation of sustainable development, provided by the International Council for Local Environmental Initiatives, is more useful if we seek to apply the concept in Europe's urban areas: **"Sustainable development is development that delivers basic environmental, social and economic services to all residents of a community without threatening the viability of the natural, built and social systems upon which the delivery of these services depends."**

The main principles of sustainability are:

- The standard of living must be based on the carrying capacity of the natural environment.
- Sustainability must be based on social justice.
- Water and energy resources must not be consumed more rapidly than natural systems are able to replenish them.
- Non-renewable resources must not be consumed at a rate greater than the one that is necessary for the development of sustainable, renewable resources.
- The rates at which pollutants are emitted must not exceed the air, water and soil's capacity to absorb and process them.
- Maintenance of biodiversity is and must be a prerequisite for sustainability.

Analyzing the challenges that many cities were faced with in their efforts to achieve a more sustainable development, invariably give a high priority to the problems of mobility and access. At the urban level, where transport problems are more acute and concentrated than elsewhere, achieving a sustainable form of mobility is a prerequisite for the improvement of both the environment, including social aspects, and the economic viability.

A great deal of research has been conducted in recent years. The European Commission has addressed this issue in research documents and in the Green Paper on Impact of Transport on the Environment. Dealing with urban mobility problems is now a priority in the EU's transport and environment policies as outlined in The Future Development of the Common Transport Policy and the Fifth Environmental Action Program. The Fifth Environmental Action Program identifies the impacts of transport on the environment as well as it specifies measures to reduce them. It sets out a time-scale for implementation and identifies the actors involved, including the EU, Member-States and local government.

Further steps have been taken by the European Commission through the publication of the Green Paper Towards fair and efficient pricing policy in transport. This publication selects urban areas as

targets for a new comprehensive policy response to ensure that prices reflect underlying deficiencies, which otherwise would not be taken into account seriously. The Green Paper Citizens' Network - Fulfilling the potential of public transport in Europe emphasizes the essential role of public transport in improving the quality of life and the environment.

Through the Fifth Environmental Action Programme the EU recognizes that the approach to environment policy based on legislation, on which the EU has long relied, is characterized by a considerable gap between policy formulation and implementation preventing the achievement of sustainable development objectives. The Programme therefore adopts a new approach to tackling environmental problems and proposes new instruments. The key elements of the new approach involve integration - both internal integration between the various environmental issues and external integration of environmental objectives into other EU policies - and the concept of joint and shared responsibility for the environment between the EU and Member- States, along with other relevant partners, including local governments and municipalities.

In February 1993, The Fifth Environmental Action Programme, which sets the environmental agenda for the period 1993 to 2000 and beyond, was officially adopted. It was supplemented by a report on the State of Europe's Environment. Compared to earlier environment programmes, the Fifth Programme is directed towards dealing with the root causes of environmental problems rather than with treating its symptoms. The aim of the Programme is to introduce changes in current trends and practices and ultimately to achieve change in patterns of human consumption and behaviour. The significant thing in this Programme is that transport and industry are identified as key sectors in which combined approaches to sustainable development must be adopted. In order to achieve many of the Programme objectives, The Action Programme also places considerable emphasis on the role of land use and strategic planning.

Local authorities in the European Cities and Towns Campaign have expressed growing interest in managing urban stress in Europe and CEE. This Europe-wide initiative currently involves over 400 European local authorities, from Reykjavik, Iceland to Corfu, Greece. Five international local authority networks are associated with the campaign: the Council of European Municipalities and Regions, Eurocities, the Healthy Cities Network of the World Health Organization, the United Towns Organization and the International Council for Local Environmental Initiatives (ICLEI). The EU's environmental directorate, DGXI, provides the main funding support. The main goal of the campaign is to increase the number of sustainable cities among EU's members through Local Agenda 21 actions. Local Agenda 21 is a plan for keeping future economic development of a municipality in harmony with its environmental and social needs and limitations.

The importance of Local Agenda 21 for cities and towns was emphasized in its 28th Chapter, the document evolving from the 1992 UN World Environment and Development Conference. Chapter 28 states that "local authorities in each country should have undertaken a consultative process with their population and achieved a consensus on a Local Agenda 21 for their community" by 1996.

The European Cities and Towns Campaign was launched in May 1994 at the First European Conference on Sustainable Cities and Towns in Aalborg, Denmark. Eighty authorities signed the Aalborg Charter, committing themselves to long-term action plans toward sustainability and implementation of Local Agenda 21 processes. Twenty-nine CEE and NIS municipalities have so far signed the Aalborg Charter from Tirana, Albania to Tartu, Estonia.

The Second European Sustainable Cities conference was held in Lisbon in 1996, bringing in over 1000 local and regional representatives who were evaluating progress made since Aalborg and who agreed on the Lisbon Action Plan.

In Lisbon, they also came to a decision to hold four regional conferences between 1998-99. The purpose of these conferences would be to better understand the specific urban problems of the northern, southern, eastern and western European regions. The first was held in September 1998 in Turkey, Finland, and all Baltic cities agreed to begin Local Agenda 21 actions before 2000. The second conference, covering CEE, southeastern Europe and NIS, was held in Sofia, Bulgaria. The Mediterranean region was covered in January 1999 in Seville, Spain. Western Europe will be assessed this summer in The Hague, Netherlands. The Third Pan-European Conference was held in February 2000 in Hanover, Germany. Conference participants wrote a set of priority issues and

recommendations that would guide their sustainable development work into the future. The conference was also a chance for CEE and NIS cities and towns to talk about the problems and strategies they have in common.

In 1994, Aalborg hosted the First European Conference on Sustainable Cities & Towns at which the Aalborg Charter was signed. The Charter is compounded from some kind of statement of demands for Agenda 21 deriving from the 1992 Rio Declaration. By September 1996, 245 local authorities from 27 European countries, representing more than 80 million European citizens, had signed the Charter. They committed themselves to enter the Local Agenda processes and to develop local long-term action plans towards sustainable development.

- **International action for sustainable cities**

In 1987 eleven European cities became the founding members of the World Health Organization's Healthy Cities Project. Thirty-five European cities now lead a much-extended Healthy Cities movement, and its principal aim is the improvement of living conditions in cities. The strategic management approaches and mechanisms developed by Healthy Cities, with their strong emphasis on community partnership, networking and the innovative use of indicators and targets are of particular relevance for the European Sustainable Cities Project. The WHO Global Strategy for Health and Environment (WHO, 1993) is closely linked to Agenda 21and makes strong connections between health, environment and development.

In 1990 the United Nations Centre for Human Settlements-UNCHS (Habitat) launched its Sustainable Cities Programme. Its principal goal was to provide municipal authorities in developing countries "with an improved environmental planning and management capacity which will strengthen their ability to define the most critical environmental issues, to identify available instruments to address these issues, and to involve all those whose cooperation is required in concerted and practical action". The Programme was designed to promote the sharing of expertise among cities in different regions of the world.

In September 1990, representatives of more than 200 local authorities from all parts of the world founded the International Council for Local Environmental Initiatives (UNCHS, 1990.). As a network of local authorities, ICLEI facilitates the exchange of experience among cities, towns and counties and broadcast examples of good environmental practice worldwide. ICLEI is also facilitating the Local Agenda 21 Model Communities Programme.

In August 1991, one hundred and thirty cities signed the Toronto Declaration on World Cities and their Environment, committing their cities to the preparation of sustainable development plans.

In May 1992, forty-five cities were taking part in the World Urban Forum, one of the events associated with the UNCED conference. They signed the Curitiba Commitment for sustainable urban development. In many ways the Curitiba Commitment provided a detailed action plan that individual cities could follow in drawing up action plans for sustainable development in consultation with their local communities.

The European Sustainable Cities Project is closely linked to other ongoing programmes addressing urban environment/development relationships, including, for example, the UNDP/World Bank/UNCHS Urban Management Programme and the UNDP/World Bank Metropolitan Environmental Improvement Programme. One of the outputs that is of a particular interest to the European Sustainable Cities Project is the guide to the preparation of city environmental strategies that was being prepared by the World Bank as well, in cooperation with UNDP and UNCHS, as defined in the paper Toward Environmental Strategies for Cities (World bank, 1993).

The OECD's Urban Programme aims to improve understanding of the urban areas ecosystems, to evaluate examples of good practice in urban environmental improvement and to assess the effectiveness of integrative policies by local authorities and by other agencies in the public, private and voluntary sectors at various levels of government. A number of general policy principles and guidelines have emerged from this programme, all of them being of relevance to this report.

The OECD publication Environmental Policies for Cities in the 1990s, significant for demonstrating the strength of international concern for environmental issues in cities, also progressed towards developing a set of operational principles for environmentally-sound urban management. More recently, the OECD Environment Group on Urban Affairs has agreed upon a working programme in the period 1994-95 on The Ecological City, which was of particular relevance to the European Sustainable Cities Project. This project is principally concerned with policy and processes development. Among the objectives are the explanation of the meaning of sustainability for cities and the methods by which it can be carried on. So far, the results of this programme suggest approaches similar to the proposals in this report.

The UN Conference on Environment and Development, held in June 1992 in Rio de Janeiro, focused the world's attention on the need to promote sustainable development on a global scale. The EU played a leading role in the negotiations at Rio, and the EU and all Member- States signed the Framework Convention on Climate Change and the UN Convention on Biodiversity. The Framework commits them to taking actions in order to return the carbon dioxide and other "greenhouse gases" emission to their 1990 levels by 2000, and the UN Convention on Biodiversity sets up a framework for international cooperation to protect the world's species and their habitats.

In June 1993, the European Council of Ministers adopted a Decision for a monitoring mechanism of Community carbon dioxide and other greenhouse gas emissions. The Decision requires that all Member States devise, publish and execute national programmes for limiting their carbon dioxide emission in order to contribute to the realization of the commitment from the UN Framework Convention on Climate Change, as well as to the Community's own objective to stabilize carbon dioxide emission in the year 2000. The Commission is responsible for the evaluation of the national programmes in order to assess whether progress in the Community as a whole is sufficient to guarantee fulfillment of the two commitments mentioned above.

In addition, all Member-States committed themselves to the Rio Declaration on Environment and Development (The Earth Charter) and to Agenda 21, a detailed action plan setting out specific initiatives that nations should undertake. It appeals to governments to prepare national strategies for sustainable development and requires from them to submit progress reports to the UN Commission on Sustainable Development (CSD). This Commission was established in 1993 to monitor progress in executing the agreements reached at Rio.

As part of their follow-up to UNCED, Member- States made a commitment at the European Council meeting in Lisbon in June 1992, to create national action plans for the implementation of Agenda 21. This was an act additional to the commitment to prepare national reports for the CSD. In their sustainable development plans, Member- States need to have regard for the Fifth Environmental Action Programme that provides many of the policy and financial instruments needed to fulfill the Rio commitments.

Unlike the Conventions, which become legally binding once the signatures are ratified, Agenda 21 is not a legally binding agreement. However, its influence is considerable and there is not enough space in this report to represent fairly the large volume of work that is being done worldwide under its auspices. Within Agenda 21, the concern is not limited only to the physical environment. World trade, poverty, population growth, health, and international cooperation and coordination are among the addressed topics. There are forty chapters, each of which includes a statement of objectives, an outline of required actions, guidelines for developing a framework for action, necessary institutional conditions, and the means of implementation, including finance.

Much of Agenda 21 has relevance to the urban environment. For example, the promotion of sustainable urban economies, land use and management are strongly featured. There is also a requirement to integrate transport and spatial planning. Local governments are given a key role in ensuring implementation of the Agenda 21 commitments. A summary of the main points of interest to local government is presented in LGMB, 1992b. Chapters 7 (Sustainable Human Settlements) and 28 (Local Authorities) are of particular importance. Chapter 28 sets out targets for local authorities saying that by 1994 "representatives of associations of cities and other local authorities should have increased levels of cooperation and coordination with the goal of enhancing the exchange of information and experience among local authorities". By 1996, local authorities should have

"undertaken a consultative process with their populations and achieved a consensus on Local Agenda 21".

Networking acquired a higher profile during the 1980s, with the European Commission encouraging the efforts to foster economic and social cohesion between regions. Commission support has particularly increased since 1991, with the development of the RECITE initiative (Regions and Cities for Europe).

Several existing European local government networks have an environmental dimension or have been established according to the policy areas picked out for detailed examination in this report. The Eurocities network (representing large cities) and the Commission de Villes (representing smaller and medium sized cities and towns) are wide-ranging, fostering initiatives in, for example, environmental action, transport, economic development and urban renewal. More specialized networks include, for example, Energy Cities in the field of urban energy management, Environet in the field of economic development; ECOS, POLIS, Public Transport Inter-change and the Car Free Cities Club in transport; and ROBIS, which deals with the recycling of land for residential and commercial development, in the area of spatial planning.

Networking for sustainable development is specifically mentioned in Agenda 21, and relevant examples of international cooperation between cities were outlined earlier in this chapter. Building institutional capacity as well as sharing ideas and technical know-how are the important aspects of networking for sustainability. Some existing European networks, such as Eurocities, have recently taken steps to focus on sustainability objectives. New networking arrangements are also being established. For example, as an input to the implementation of the Climate Change Convention, ICLEI has initiated a Cities for Climate Protection Campaign. To join, cities must commit to a local action plan to reduce greenhouse gases emission. In March 1993, eighty-three European cities started the European Cities for Climate Protection Campaign in Amsterdam. Some 360 European cities are members of the Climate Alliance of European Cities together with the Indigenous Rainforest Peoples of the Amazon.

The European Sustainable Cities and Towns Campaign, based on the Aalborg Charter, was launched in May 1994 and was supported by major European networks of local authorities, including CEMR, Eurocities, ICLEI, UTO and WHO. Its aims are to promote development towards sustainability at the local level by encouraging cities to enter Local Agenda 21 as well as some similar processes, and to provide assistance for cities that are developing their long-term environmental action plans towards sustainability. Activities of the Campaign, together with the work of Expert Group on the Urban Environment on policy for sustainable cities, form the principal components of this European sustainable cities project funded by the DG Environment. A second European Conference on Sustainable Cities and Towns was held in Lisbon, Portugal, in October 1996.

Local Agenda 21 is essentially a strategic process of encouraging and controlling sustainable development. The development, management and implementation of this process require all the skills and tools that would be supported by a local authority and its community. Knowing that local authorities do not have much experience with such strategies, it is clear that they need advice in defining the tools and management systems that are most appropriate for achieving progress.

3. KEY SUSTAINABILITY ISSUES

3.1. Movement in cities

Mobility is essential to the livelihood of cities. However, the reached saturation levels of traffic, due to the dominance of the private car, are diminishing the efficient functioning of many cities by reducing accessibility and damaging the environment in the long term. Over the past forty years, patterns of urban change in Europe have led to significant changes in the way that people travel and the distances that are traveled in urban areas. Development and lifestyle changes have encouraged the alienation of resident and business areas. This has resulted in a great increase of traffic flows and a dramatic shift in modes of transport, from walking, cycling and public transport to the private car. In many cities in the EU the car accounts for over 80% of urban mechanized transport.

As for the future, the total annual number of kilometres per car in the EU is expected to increase by 25% between 1990 and 2010. During the same period of time, road haulage is expected to increase by 42% and rail freight increasing by only 33% the same period. Traffic expansion on a large scale would jeopardize the Union's ability to meet the concluded environmental targets about the quality of air, greenhouse gas emissions and the protection of landscapes. To achieve a more sustainable form of urban mobility and to improve accessibility, it will be necessary to reduce transport in the long run. Among other things, it will be necessary to minimize or even stop the predicted growth in the number and length of journeys and therefore minimize the transport demand in the short run.

Existing policies, which seek to influence competition between transport modes in urban areas, may not encourage individuals to take environmental impacts into account when making decisions about urban travel. It is incorrect to assume that individuals make rational choices based only on their own disposition for particular modes and destinations. The character and availability of competing systems are strongly influenced by the policies of central and local government. Current policies tend to encourage competition but they often put particular modes at a disadvantage, for example the modes in which levels of investment are insufficient.

In certain urban areas, the limitations of sustainability have already been exceeded from both an environment and a transport point of view. Movements into and within many cities and towns are becoming even more difficult and sometimes unsafe. Increasing air and noise pollution adds difficulties to congestion, making city travel unpleasant, lessening the quality of life and increasing health risks to a part of the population. The evidence emerges to show that, over a long period of time, unsustainable and inefficient mobility will have a damaging effect on the economy of our cities.

3.2. Environmental problems

- **"Conventional" emission (air pollution)**

  Transport is now the major source of the air pollutants found in European cities. Road traffic is mostly responsible for the high level of summer smog in Europe, and World Health Organization guidelines for ozone, NO_x and CO emissions have been violated on numerous occasions. Surveys show that, for example, in 70-80 % of European cities with more than half a million inhabitants, air pollution levels exceed these WHO guidelines at least once year. In some southern European cities levels of air pollution are at times so high, that traffic restrictions or bans are introduced for certain days or for a certain period of the day.

  Although the recent and approaching legislation on exhaust emissions of cars and lorries will result in substantial reduction of pollution from individual vehicles, the projected increase in vehicles and kilometres will, over the medium term, largely offset the potential reductions. Therefore, there is a general agreement that technology alone will not solve the air pollution problems caused by transport.

  Private-vehicle travel tends to generate larger amounts of emissions per unit distance traveled than public transport modes (Table 1), but this is probably too general a statement to be of much value in any specific local circumstances. Clearly, many other factors are involved, including average vehicle occupancy rates, the age and maintenance level of the respective vehicle fleets,

and so on. The technologies for reduction of emissions from spark-ignition (i.e., gasoline powered) engines were first introduced in the United States and Japan in the late 1960s. Europe followed with similar regulations a decade later. Standards for exhaust emissions, and for evaporative emissions of VOCs from vehicle fuel systems, have become more rigorous and are scheduled to continue that trend. In the most strictly controlled regions, emissions from new vehicles are 90% to 98% lower than they were prior to the control. This step-by-step regulatory approach is followed in other parts of the world as well, though with some delay.

Table 1. – Emission rates in London (grams/passenger-km) by mode, 1997.

	Private Motor Vehicles				
	4-wheel	2-wheel	Taxis	Buses	Metro
Carbon monoxide	12.9	8.9	1.8	0.3	0.03
Hydrocarbons	1.9	1.1	0.6	0.1	0.0
Oxides of nitrogen	0.8	1.0	1.8	1.2	0.3
Oxides of sulfur	0.05	0.06	0.15	0.02	0.15
Lead	0.02	0.02	—	—	—
Particulate matter	0.04	0.04	0.55	0.02	0.01
Carbon dioxide	197	115	470	89	91

Source: London Transport Buses (1999).

The emissions from vehicles powered by compression-ignition (i. e. diesel) engines (including trucks, off-road construction vehicles, railroad locomotives and waterborne vessels) were earlier less strictly regulated than emissions from gasoline engine vehicles. In part, that was because exhaust treatment technologies — catalysts for NOx, traps for particulates — were not sufficiently developed to enable their widespread use.

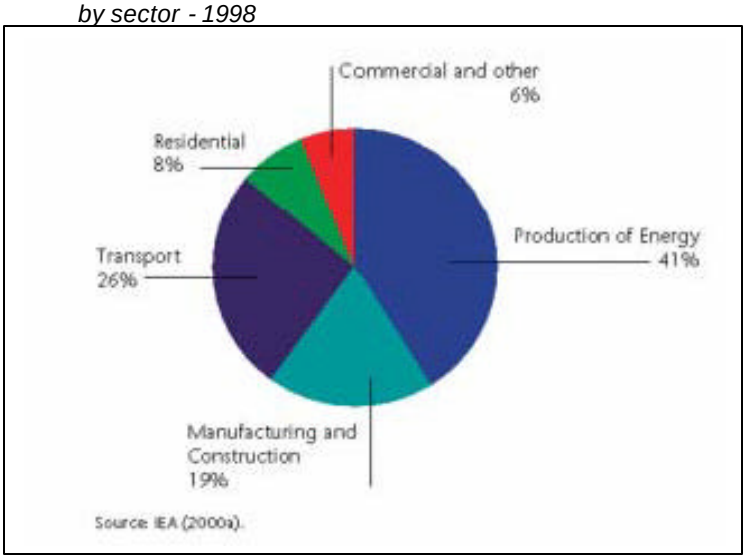
The adoption of more effective abatement technologies (generally in response to more demanding government-imposed emission standards) will lead to significant reduction per vehicle emission rates. This will not, however, automatically affect the equivalent reductions in total vehicle-related emissions.

- **Greenhouse gas emissions (CO_2 emission)**

As far as the energy is concerned, the transport sector represents about 30% of total energy consumption in Europe, more than 20% of the early 1970s. Over 84% of energy consumption through transport goes to road transport. Fuel consumption from the vehicle fleet has hardly changed over the past twenty years - major developments in engine and vehicle technology have been more than neutralized by the increases in the fleet, congestion and increases in engine capacities. Increased energy consumption has led to a significant increase in CO_2 emission by transport - 63% in the EU since the early 1970s. According to the latest trends, an additional 25% increase by the transport sector is forecast by the end of the century. This would represent 30% of total CO_2 emissions in the EU compared to the figure of around 25% that we have today. It is estimated that urban traffic is responsible for almost half of the transport CO_2 emissions.

Some other emissions from transportation — methane, nitrous oxide (N_2O), and vehicle air-conditioning refrigerants — are also greenhouse gases. These gases have a much higher potential effect on climate change than CO_2, although their atmospheric concentration is much smaller.

Figure 1. – Share of worldwide CO_2 emission from the combustion of fuel, by sector - 1998



- **Health problems**

  Several studies point to the link between urban traffic and health damage. Swedish studies have uncovered that urban air pollution causes annually 300-2000 new cases of cancer. Traffic accounts for 70% of the emission of carcinogenic substances as well as of the substances that may affect the genes of people living in urban areas. A British Government study found a link between emission particle levels and cardio-vascular diseases, and indicated that up to 10,000 people in England and Wales have been dying each year because of exhaust fumes. Since it is difficult to find conclusive links, there is a widespread evidence of the effects that major transport emitted pollutants have on health. This area calls for more research, especially in local communities.

- **Noise pollution**

  Cars and trucks are major sources of noise pollution in most cities. The most developed countries have had vehicle noise emission regulations since the 1970s. Technological progress in engines and exhaust systems has made these vehicles considerably quieter.

  The vehicle noise emission can be reduced by aerodynamic vehicle body designs (which also have the effect of improving fuel efficiency and reducing emissions). It can be reduced through tire tread designs and improvements in pavement surface textures (which also have the effect of removing water more effectively and thus reducing the risks of accident). Noise barriers can also minimize the impact of vehicle noise on the surrounding.

  Road traffic is the main source of noise pollution. Air traffic is also important, but it affects a much smaller part of the population. The report *Europe's Environment: The Dobris Assessment* estimates that nearly 450 million people in Europe are exposed to noise levels of over 55 dB(A), while nearly 113 million people are exposed to more than 65 dB(A). These are the unacceptable noise levels that may lead to a damage of health.

  An example of a project designed to measure and tackle the impacts of transport on environment and health, is the trans-European project involving Kirklees, Berlin, Madeira and Copenhagen. The project, founded under the LIFE programme, is seeking to provide very detailed information about how transport effects air pollution, noise and health. Geographical information systems will be used to model transport scenarios for the year 2012.

3.3. (In)accessibility

Inaccessibility is an increasing problem in urban areas. In the majority of cities, there is a consistent trend towards decentralization of both people and their working places from inner to outer areas, regardless of whether the city is growing or diminishing. Locating the new development on green field sites in peripheral areas is a trend that creates longer journeys and additional traffic. It makes no difference for a car user, but to those dependent on other forms of transport it does. Such developments are often located in low-density areas, where the costs of providing satisfactory public transport are generally too high. The social implications of migration into suburbs developments would not be so extreme if local facilities were available within the cities. Problems arise when the expansion to green field sites is followed by the closing down of local services. The result is that some people are becoming more and more isolated from the services necessary for their everyday life.

Changing lifestyle is another factor which in itself causes car dependency on a higher level, and inaccessibility for those who cannot afford a car, or are not able to drive one. It seems logical that higher densities and mixed developments would increase accessibility.

Traffic congestion causes significant speed reductions in city traffic, leading to average speeds that have not been seen since the beginning of this century. A recent study found that traffic speed has been reduced by 10% in major OECD cities over the last twenty years. In one third of the surveyed cities the early morning speed in the city centres was below 19 km/h.

Congestion increases polluting emissions and fuel consumption. Current speeds in many large cities are in the most inefficient area of the speed/fuel consumption curve. Congestion also affects public transport, making it even less attractive and less appealing to the potential users. Congestion, defined as 'additional time spent traveling compared with free-flowing travel' is estimated to cost about 2% of GDP.

4. SUSTAINABLE MOBILITY

People desire mobility. They desire it both for their own sake and for the sake of their overcoming the distance between their homes and the places they work in, shops, medical centres, schools or the places of their friends and relatives. Business requires mobility as well for the sake of overcoming distance — the distance that separates manufacturers from the sources of raw materials, from the markets, and from the employees. However, mobility is also associated with a variety of negative impacts — congestion, pollution, greenhouse gas emissions, disruption of neighborhoods, noise, accidents, etc. Another concern is that the world's current mobility systems rely almost exclusively on a single source of non-renewable energy, i. e. petroleum. The tension between the desire of humankind for mobility and its concern about the negative impacts associated with mobility raises the question of whether mobility is sustainable.

"Sustainable mobility" is a term that allows different meanings. The World Business Council for Sustainable Development defines **"sustainable mobility"** as **"the ability to meet the needs of society to move freely, gain access, communicate, trade, and establish relationships without sacrificing other essential human or ecological values today or in the future."** This definition emphasizes the social aspects of mobility. But for many people the term "sustainable mobility" reflects more mundane concerns — concerns relating to whether the transportation systems on which our societies have become dependant can continue to function good enough to meet our future mobility needs.

Under different circumstances, different ways of transport offer different levels of mobility and accessibility. In urban settings, the car provides the highest level of accessibility. Car users do not have to accommodate their schedule. They can leave whenever they wish and they can usually choose the route to their destination.

Mobility also shapes our settlements. Today, two dominant phenomena are shaping the pattern of human settlement. The first is urbanization — the tendency of populations to concentrate in the cities. The second is decentralization — the tendency of these same urban areas to expand outwardly outside their current area. The expansion generally happens at rates faster than overall population growth, producing net declining in the population density of metropolitan areas. Neither of these phenomena could be happening without increased mobility. Mobility systems affect urban growth in an important way, because they make certain city areas more or less accessible, altering the terrain values and the attractiveness of area for various users.

If mobility is to be made sustainable by 2030 — the stated goal of the World bank Commission on Sustainable Development (WBCSD) member firms — the measures that will eventually produce the necessary changes must be undertaken almost immediately.

For mobility to be sustainable, accessibility must be improved and at the same time avoided disruptions in societal, environmental, and economic welfare which would more than equalize the benefits of the accessibility improvements. This means that any assessment of mobility's sustainability must include not only a judgment in favour of its effectiveness when improving accessibility is concerned, but also a judgment in favour of the importance and consequence of any disruptions associated with social, environmental, or economic welfare.

Mobility itself requires access, and this can be impeded by cost as well as by location. As it has already been noted, privately owned motor vehicles are typically the most flexible means of mobility. But in many parts of the world, the cost of purchasing, garaging, maintaining, and operating such vehicles is well beyond the means of the great part of the population. People must walk, use bicycles or two-wheeled motorized vehicles, or rely on various forms of public transport. Bicycles are limited in their range and the amount of weight they can carry. Two-wheeled motorized vehicles are less limited in both of these regards, but are still expensive. Public transport is generally less expensive in terms of the daily cost, but is often difficult to reach and provides relatively poor and inflexible service. Increasing access to flexible, affordable means of mobility can be achieved through improvements in any or all of these various dimensions. Reducing the cost of various types of motorized vehicles is one step further towards the improvement. Improving the flexibility and accessibility of public transport systems is the second step. Developing new transportation devices that combine flexibility with low cost is the third.

Personal mobility can be improved on an individual basis and in a rather short period of time. The tend of traveling by private car consumes more space and infrastructure per unit of travel than does traveling by public transport, though the validity of this broad generalization depends entirely on the passengers using the public transport. Full buses provide more efficient use of road infrastructure than cars do, and empty buses are less efficient.

With the incomes rising, the mobility demands of an increasingly large and more urban population are increasing. Over the last fifty years, data from all regions of the world demonstrate that travel (the average number of kilometers traveled by a single person per day) increases as consistently as income does — and income, no matter how unevenly it is distributed, is increasing all over the world. As income rises, people go on trips more and more, but for the reasons different than survival. For example, in the industrialized world, only 20-25% of all travel is now work-related. Another notable historical observation is that people travel further distances as their income rises, but the period of traveling does not last longer. On average, they spend roughly an hour a day traveling, regardless of distance. That means, of course, that people's choice shifts to faster means of transportation, from walking to bus, train or two- and three-wheeled vehicles, then to cars, and ultimately to high-speed trains and airplanes. Not only that this change to faster vehicles is more expensive but it also causes the consumption of more energy per passenger in terms of kilometers traveled. Almost all of the motorized vehicles (except for electrified trains) share one crucial characteristic: they are driven by a combustion engine. No other transportation power plant can match the compactness, cost, flexibility and reliability of the two widely used versions of this engine — the gasoline spark-ignition and the diesel compression-ignition engine. During the XX century, technical advances in the combustion engines, and the vehicles they power, have reached constant improvement in the performance, convenience, and safety of all motorized vehicles. Current trends suggest that these engines will continue to improve, forming a powerful competitive barrier for new technological participants to the marketplace.

The most significant factors increasing the demand for mobility in the twentieth century are the rapid growth of the population in the world, their constant migration into cities, and the decline in the population density (inhabitants per square kilometer) in these cities. The industrialized world has already been largely urbanized: about 75% of its population is currently concentrated in urban areas, and this portion is projected to increase to nearly 85% by 2030. As a contrast, only 40% of the population in the countries of the developing regions lives in urban areas, though there are regions that are highly urbanized — e.g., Latin America, where 75% of the population is urbanized. By 2030, urban areas in the developing world are expected to house about 56% of the entire population of those regions. Globally, 60% of the world population is projected to reside in urban areas in 2030, which is much more than the approximate 47% in 2000. The consequence of these two trends — the process of urbanization, and its increasing concentration in the developing world — is most strikingly illustrated by the increase in the number of mega cities.

The broad patterns of travel behavior — increasing trip frequency, trip distance, and travel expenditure as incomes rise — become evident in the statistics of passenger transport all over the world. Between 1950 and 1997, the total number of kilometers traveled each year by a single person increased more than threefold. The total transportation system, adjusted to both the increase per capita and population increase, provided over eight times more passenger-kilometers in 1997 than in 1950.

The average world growth rate of kilometers traveled annually has been rising at an impressive rate of 4.6% per year. The growth rate in some poor regions is even higher. China is just the example, with the growth rate of 9.4% per year, although from a generally adopted low base. Table 2. lists some statistics of growth, in both absolute and percentage terms, of all means of transportation over the 1950-1997 period. Total passenger travel in industrialized regions of the world is now approximately equal to total travel in all other regions; in 1950, it was almost four times as large. Non-developed countries surpassed the total-travel gap and would move ahead, perhaps notably ahead, in the future.

Table 2.- Growth in passenger-kilometars traveled

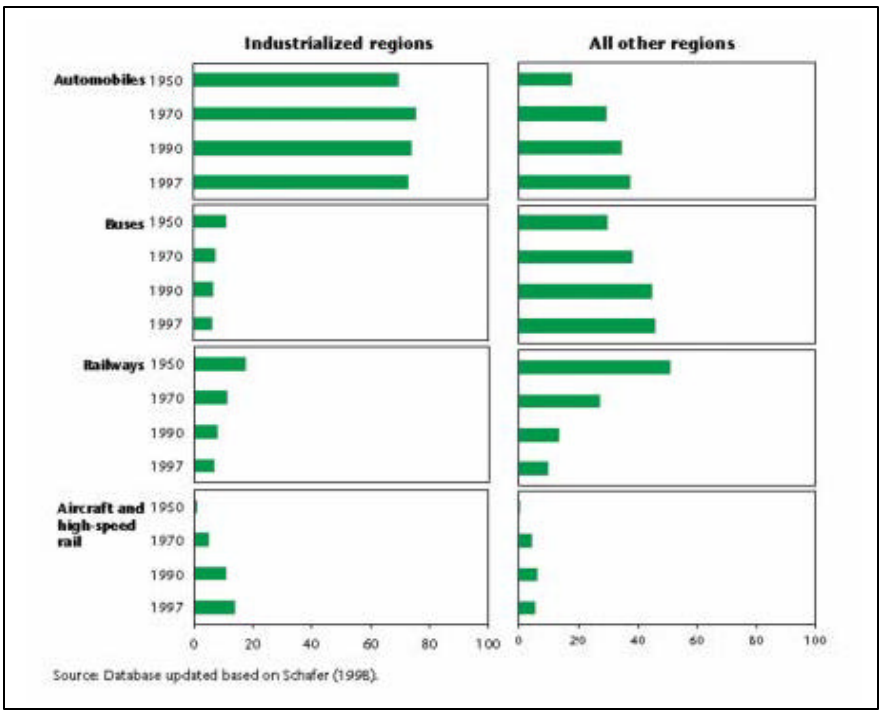
	1950		1997		AAGR*, %/yr	
	Per Capita	Total (billions)	Per Capita	Total (billions)	Per Capita	Total (billions)
Industrialized Regions	**4,479**	**2,628**	**16,645**	**14,951**	**2.8**	**3.8**
Other Regions	**373**	**717**	**2,627**	**12,998**	**4.2**	**6.4**
World	**1,334**	**3,345**	**4,781**	**27,949**	**2.8**	**4.6**
Specific Segments						
United States	11,205	1,706	24,373	6,530	1.7	2.9
Western Europe	1,668	542	12,631	5,658	4.4	5.1
Former Soviet Union	705	127	4,152	1,250	3.8	5.0
China	NA	NA	1,313	1,634	NA	NA
India	348	125	1,457	1,392	3.1	5.3

Source: Updated database based on Schafer (1998).
*Average Annual Growth Rate, 1950 to 1997.
NA–Data not available.

Although there is equality in total passenger-kilometres traveled, annual travel per capita is still about six times high in industrialized countries as it is elsewhere. In addition to overall growth measured by the distance traveled as a whole, there have been major shifts among means of transport. As people earn more and travel more, they use faster or more convenient (and less energy-efficient per passenger-kilometer) vehicles, i. e. cars in particular.

In that respect, rail travel is the one that loses the most. In fact, since 1950, the use of rail travel has decreased dramatically as compared to the total travel, especially in non-developed regions where it was the dominant form of motorized travel (see Figure 2). In industrialized regions over the last fifty years, cars accounted for an approximate stable 70-75% of the passenger-kilometers traveled. As a contrast, in non-developed regions, car travel rose from less than 20% on the whole in 1950 to about 40% of today, and that share is continuing to rise. Bus travel in industrialized regions have been steadily declining to a share lower than 10%, while in other regions it has risen to about 45% — providing for the preferred method of public transportation since the use of railway declined.

Figure 2. – Percentage shares of total passenger-kilometars traveled



Focusing on motorized transport makes it easy to forget that a part of the world's population travels on foot or by bicycle. Walking or bicycling accounts for more than half of all trips made in a number of Indian cities, and 60-90% of all trips in many Chinese cities. In poorer rural areas, the dominance of non-motorized transport is even greater. Although approximately one-third of all "trips" are made on foot in OECD countries, the short trips (generally well below one kilometer) result in an almost insignificant traffic volume. Travel surveys suggest that walking accounts for less than 5% of total passenger-kilometers in Western European countries and merely 0.5% in the United States.

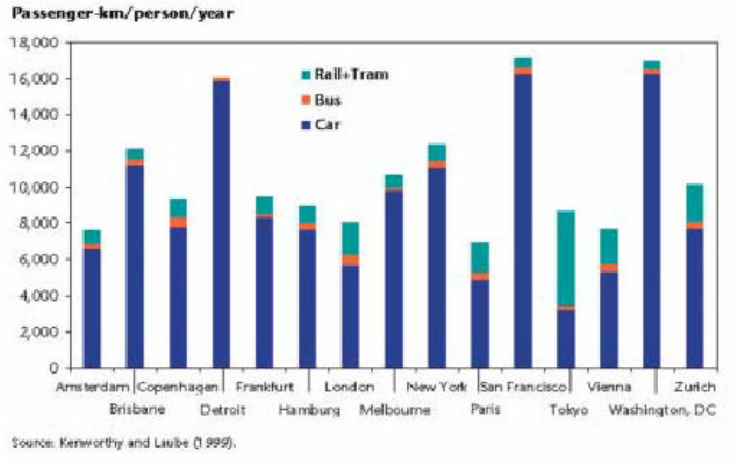
4.1 Mobility in the urbanized regions

In all urban areas of the developed world, the cars play the dominant role in providing urban mobility. Public transport is still very important, especially in Europe, but its share of total passenger-kilometres has been falling almost everywhere. Car ownership and use has substantially grown over the last fifty years. This, in turn, has caused the decline of average population density in urban areas, further damaging public transport's competitiveness. Technology has enabled some reduction in the total transportation-related emissions of carbon monoxide, sulfur dioxide, and volatile organic compounds. However, slow fleet turnover, lack of proper maintenance, changes in the mix of light-duty vehicles, and increased driving has kept the reduction of total emissions well below the reduction of new vehicle emissions. Transport-related emissions of carbon dioxide have not declined. Improvements in fuel efficiency of new vehicles have been more than neutralized by increases in the total number of vehicles, changes in vehicle mix, and increases in vehicle utilization. Accident rates have decreased since vehicles and roads have been improved. Congestion appears to be increasing, though the actually comparable cross-national data on congestion are difficult to find. A range of strategies is being tried in different urban areas to offset the adverse impacts of motor vehicles. These include restrictions for using the car in the centre of the city, traffic "calming", the promotion of carpooling, and various approaches to promoting the increased use of public transportation. Technology guides us how to increase the capacity of existing highway infrastructure, and the interest in the use of congestion charges and pollution charges seems to be growing.

Figure 3 provides an overview of the contribution of the major modes of transport to mobility through a selection of cities across the developed world. It clearly indicates the dominant role of the cars in providing urban mobility. In the developed world, the private vehicle has become the most common

form of motorized transportation, accounting for about 40% of passenger-kilometers traveled in Tokyo and over 95% of passenger-kilometers traveled in the cities of the United States. Public transport plays a smaller part in these countries, despite the fact that it is a very significant and important way of transport, especially in Europe and Japan.

Figure 3. - Indicators of transport use, 1990



Combining complete route and schedule flexibility with comfort, privacy, and speed, a car symbolizes to their users a very high level of mobility, significantly superior to that offered by any competitive means of transport. In the decades following World War II, rising incomes and the widespread availability of affordable cars produced sudden increases in the number of cars owners in the cities of the developed world. However, as Figure 4 shows, car ownership levels are high all across the developed world, and have been rising steadily in the last four decades. Further more, as Figure 5 shows, car use, as defined by annual passenger-kilometers traveled per person, is also high and has been increasing across the entire developed world.

Figure 4. - Ownwrship of passenger cars in OECD countries, 1960-1995

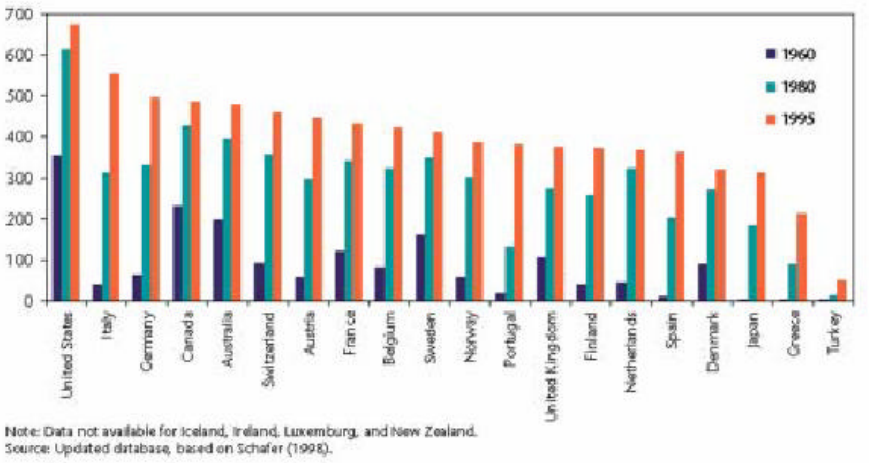
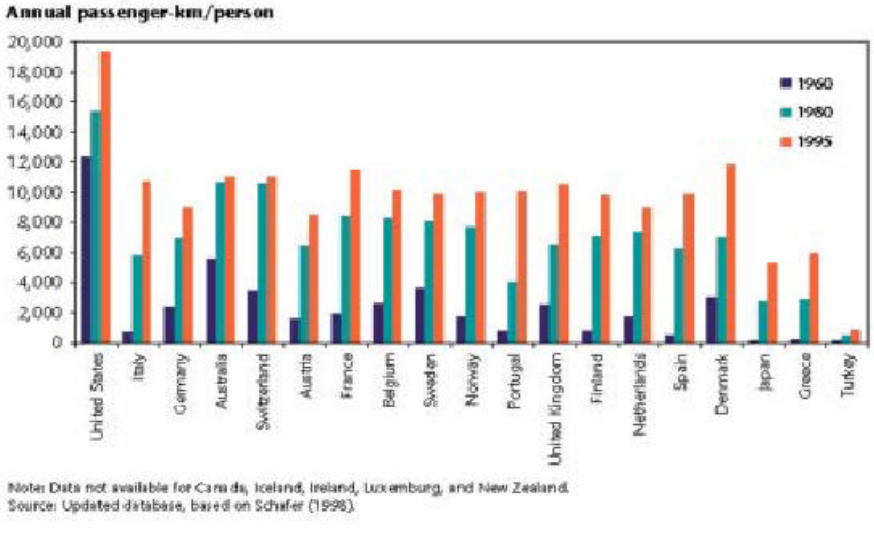


Figure 5. - Use of passenger cars in OECD countries, 1960-1995



The rise in cars ownership and car use is deeply intertwined with the growth of suburbs around the cities of the developed world after World War II. Table 3 shows in detail the population shifts in a number of cities as residential suburbs flourished and inner-city neighborhoods diminished.

Table 3. - The growth of selected metropolitan areas, 1960 -1990

Metropolitan Area	Data for 1990			Annual Rate of Change, 1960–1990		
	Population (thousands)	Area (km^2)	Density (persons/km^2)	Population	Area	Density
Tokyo	31,797	4,480	7,097	+2.4%	+3.1%	-0.6%
New York	16,044	7,690	2,086	+0.4%	+1.5%	-1.1%
Paris	10,662	2,311	4,614	+0.8%	+2.1%	-1.3%
London	6,680	1,578	4,232	-0.6%	+0.9%	-1.4%
Detroit	3,697	2,900	1,275	0.0%	+1.4%	-1.4%
San Francisco	3,630	2,265	1,602	+1.3%	+1.4%	-0.1%
Washington, DC	3,363	2,449	1,373	+2.1%	+3.5%	-1.3%
Melbourne	3,023	2,027	1,491	+1.4%	+2.5%	-1.0%
Hamburg	1,652	415	3,982	-0.3%	+1.5%	-1.8%
Vienna	1,540	225	6,830	-0.2%	+0.8%	-1.0%
Brisbane	1,334	1,363	978	+2.6%	+5.2%	-2.5%
Copenhagen	1,153	333	3,467	-0.5%	+0.7%	-1.2%
Amsterdam	805	144	5,591	-0.3%	+1.6%	-1.9%
Zurich	788	167	4,708	+0.4%	+1.2%	-0.8%
Frankfurt	634	136	4,661	-0.2%	+1.9%	-2.1%

Source: Demographia (2001).

Urban residents, who were seeking more space and privacy, began to move to the suburbs as soon as urban train systems made traveling accessible, faster and more efficient. Having been initiated in London in the 1850s and spread across Europe, the new train systems that shifted population out of the urban core were widely followed. By the early twentieth century, "streetcar suburbs" were widespread as people sought to leave the crowded, noisy, improper, and frequently unhealthy housing conditions of the inner city for cheaper housing in a more peaceful surrounding. In the early 1900s, the fixed patterns and limited capacities of the street railways limited the expansion of suburbs, but the growth of car ownership, and the suburban road networks built to accommodate it, accelerated the growth of suburbs dramatically.

The suburban migration was reinforced in some countries by national policies encouraging home ownership. As people moved to the suburbs, their employers and retail merchants followed. Cheap land was also a factor in drawing different types of business to the suburbs, where they could easily offer adequate and free parking. In an environment characterized by the widespread car ownership, public transport accessibility is no longer a significant factor in the location decisions of these firms. The dispersal of residences and jobs affected the geographic pattern of travel demands. Instead of the very high-density commuting flows between a limited number of areas (a "few-to-few" pattern of trips from the suburbs to downtown) that characterized urban areas in the early twentieth century, there is an increased number of scattered trips between many geographically dispersed origins. And this is the case for all kinds of trips, not only the journey to work. Non-work travel (shopping, personal or family business, recreation, etc.) is also likely to involve destinations that are geographically dispersed in the urban peripheries and the core. They thus require either individual trips towards scattered locations or complex trip chains that serve many purposes with only one trip. Conventional public transport is not efficient for the purpose of these kinds of trips and travel patterns.

The forces of urban decentralization are at work in Europe as well. Between 1970 and 1990, the part of metropolitan population living in the central city has declined in virtually every European city. It went down from 32% to 23% in Paris; from 41% to 38% in London; from 38% to 30% in Zurich; and from 80% to 67% in Amsterdam. Such declines occurred despite the fact that local governments in Europe have more control over land use, that public transport service is far more extensive, and suburban home ownership is not subsidized by the tax code. A striking example of an exodus to the suburbs is the former East Germany, where people are moving out of central cities in crowds, as incomes and car ownership rise. In Leipzig, a city of 500,0000 people, about 20% of city apartments are vacant, their owners having chosen to move to the suburbs — an option that was denied to them during the communist regime. Europe's middle class has moved to the suburbs — where they shop in malls, live in low-density subdivisions, and drive on traffic-clogged highways. The city as a compact urban area with clearly defined boundaries is a thing of the past in Europe. In the absence of major economic upheavals, the trends described above — those of urban decentralization and increased auto mobility — are likely to continue in the foreseeable future. Where the market is mature and car ownership levels are already high, growth in demand for cars has become steady and consists primarily of replacement vehicles and additions of second and third car to the household. However, there appears to be no similar leveling-off in the growth of travel demand. Because of the declining urban densities and a dispersal of travel origins and destinations, cars are being used more intensively, i.e. for more trips and for greater distances. Between 1970 and 2000, urban car travel per capita increased by 30% to 35% per decade in Europe (see Figure above). With rising incomes, car use is expected to continue to increase, as our society becomes ever more mobile. Future growth of the car travel per capita is expected to be especially announced in metropolitan areas, whose outward boundaries continue to expand, and whose declining population densities and increasingly dispersed travel patterns exclude an extensive use of alternative means of transportation. According to OECD forecasts, vehicle kilometers of travel in OECD countries are expected to grow over the next two decades (2000–2020) at a rate of 2% per year.

4.2. The Role of Public Transport

Public transport is an important means of mobility in the larger and denser urban settlements. But its role has been decreasing in most cities of the developed world on a grand scale as a result of the trends toward auto mobility and sub-urbanization discussed above. Buses are the most important means of local public transport in Europe.

In the European Union, public transport use has grown by 40% since 1970, though the population it serves grew by only 10%. Western Europeans therefore use public transport today more than in 1970, with buses far ahead than all the others, then rail and urban rail. Private vehicle use has grown even more markedly, but as a consequence, public transport's share of total trips has fallen from 22% to 14%.

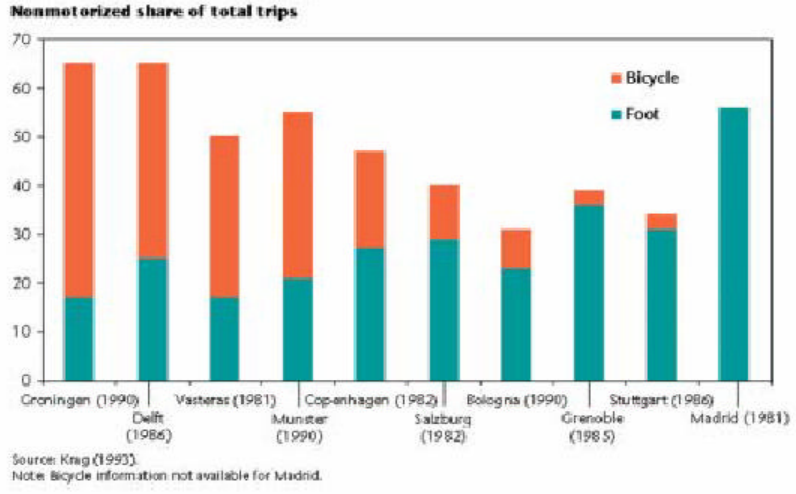
Across most of the EU, public institutions manage local public transport. Sometimes the government provides a public transport system on its own initiative, and in other cases the public sector takes over the financially troubled private operators. In France, local public transport services (outside of Paris, Marseilles, and few other cities) have long been provided by private operators authorized by local

government agencies. In recent years the rest of Europe has begun to emulate the French example, and the privatization of public transport is expanding rapidly. The degree of privatization, and whether it extends to both train and bus systems, varies widely among different countries. In the United Kingdom, outside London, bus services are fully unregulated, with the public sector's role restricted to ensuring the provision of services which were assessed as socially necessary. But the more general model for bus operations is for a public-sector client to specify the service requirement and then acquire this competitiveness from private operators. Securing private competition for rail transport is more difficult, but it has been achieved in Sweden and the United Kingdom. The evidence regarding the success of privatization efforts so far is mixed. In most cases, costs to the public fund have been reduced. In some cases, service levels have also improved, but there are evident examples in the favour of the opposite. Surely the effects have not been uniform, and concerns relating to safety and long-term economic viability remain.

4.3. Non-motorized Transport (NMT)

In almost all cities, walking is the most common mode of transport for distances not longer than 1 kilometer or so. In gentle terrain, bicycling is principally agreed to be a competitive mode for distances up to 5 kilometers or more; however, bicycle usage varies considerably from city to city. Figure 6 shows data for a number of European cities that suggest that walking and bicycling together account for a significant share of total trips in a number of cities.

Figure 6. - The role of non-motorized transport in selected European cities



There are many reasons for the various popularities of walking and bicycling. Some of the differences can be attributed to local topography and climate, but tradition and culture play a significant role as well, as transport and land-use policy also do.

4.4. Mitigating strategies

Every industrialized nation has worked hard to develop policies to mitigate the opposing effects of motorization, without diminishing the continued growth of mobility. The mitigating strategies can be classified into five broad categories:

(1) reducing the demand for car use;
(2) improving the provision of highway and public transport infrastructure;
(3) improving the transport options available for travelers;
(4) using innovative land-use and urban-design strategies to reduce travel demand;
(5) using integrated approaches that combine multiple strategies.

Each of these broad categories includes multiple strategies. For instance, the demand for car use can be reduced in a number of ways: the price of cars could reduce the demand of such; more environmentally sound paradigms of vehicles could be encouraged; car use can be restricted. Similarly, improvements could include building new infrastructure, as well as operating and managing existing infrastructure more efficiently.

(1) Reducing the Demand for Car Use
Over the last three decades, the negative effects of cars have incited the creation of several strategies to improve these effects by reducing the demand for car travel. They include direct restrictions on car use as well as a number of innovative ideas that are more nuanced in their approach.

- **Transportation Demand Management.** Transportation Demand Management (TDM) is a set of techniques that aim to reduce or redistribute travel demand, reduce solo driving, and decrease car dependency. Typical TDM techniques include promotion of carpooling, flexible working arrangements, telecommuting, road pricing, and timesaving high-occupancy vehicle (HOV) lanes. In recent years, metropolitan regions in several EU countries have adopted TDM as part of their transportation plans.
- **City centre car restrictions.** Car restrictions have won acceptance as a legitimate technique of congestion management and as an instrument of achieving sustainable mobility in crowded city centers. They are employed in more than 100 cities of Europe, North and South America, and Asia as documented by OECD surveys. Center-city restrictions vary in duration, scope, and severity, ranging from temporary traffic prohibitions in commercial districts during shopping hours to permanent closure of vehicular traffic in entire historic town centers ("car-free zones"), as in Vienna, Austria; Munich and Bremen, Germany; and Bologna and Turin, Italy.
- **Traffic calming.** In residential areas, there is a variety of regulatory and physical "traffic-calming" measures used to slow down and discourage through-traffic. The roots of the movement to reduce or "calm" vehicular traffic can be traced to Europe, where concern about traffic and the political will to act upon it surfaced in the early 1970s. The Netherlands pioneered the concept of the *Woonerf* — protected residential areas in which pedestrians had absolute priority over vehicular traffic. Cities in Germany also introduced the concept of *Verkehrsberuhigung* — a policy which limits the use of cars in residential areas using an array of techniques, such as diverting through-traffic, limiting parking in specified areas installing physical speed-restraints and declaring certain areas that are off-limits to the cars.
- **Car-sharing: Separating ownership from use.** Renting cars on a short-term basis, in other words known as "car sharing," is another strategy aimed at reducing the impact of cars on cities. Car sharing gives urban residents access to cars without requiring them to own one. This concept works because members of car-sharing organizations do not depend on cars for everyday use. The typical member of a car cooperative is a young, single, city dweller who needs personal transportation only sporadically. Car-sharing projects can generally be divided into three types: single-port systems (where users return the vehicle to the place where it came from), dual-port systems (to exchange between two stations), and multi-port systems (where the user can leave the car in each of these ports). Most of the existing car-sharing cooperatives are single-port systems. Multi-port systems remain technically challenging to implement because of the difficulty associated with keeping the vehicle offer in balance in various ports which have different demands when time and location are concerned. Auto cooperatives have been multiplying rapidly in Switzerland, Germany, Austria, and the Netherlands. Car sharing is an interesting and innovative experiment and it is not currently expected to make a large reduction in the demand for personal cars in the industrialized countries. A study, commissioned by the Swiss energy office, estimates a potential market for car sharing of not more than 1.5% of the driving population.

- **Fuel taxes: Pricing car use appropriately.** Appropriate pricing of the car as a tool toward achieving sustainability is a long-cherished goal of many economists. They argue that sustainability concerns arise because car users capture all of the benefits of their trips, but pay only a fraction of the costs. In particular, drivers do not pay the damage for the pollution, noise, and CO_2 they produce, the congestion delays they impose on other travelers, or the risks of accidents associated with their driving. Economists theorize that if drivers were asked to pay these costs through appropriate ownership and use charges, they would be more prudent in their travel choices. Lower and more sustainable levels of car use on the whole would follow as a consequence. Economists promote fuel taxes as a good (though not perfect) alternative for a "use charge" and therefore, for various pollutant emissions. The theory is that higher gas taxes influence consumer behavior in a multiple complex ways. In the short term, consumers react by reducing car use. The empirical evidence suggests that short-term effect is relatively minor — a 10% increase in fuel price translates to a 2-3% reduction in total car travel. However, such car use differences probably understate the total impact of fuel taxes on sustainability. As the cost of gasoline consumption increases, consumers buy smaller cars, more fuel-efficient cars and thus reduce their gasoline consumption per kilometer traveled and organize their lives (and the places where they live) in such a way that it does not require much driving. Furthermore, organizing the lifestyle in a way that it requires less driving, produces more compact suburbs and cities. It is true, empirical analyses of the effects of price on gasoline consumption in the OECD countries, indicate that price increase has a very significant effect on gasoline consumption (and consequently on CO_2 emissions). The range of estimations varies significantly through studies and across different countries. The evidence suggests that a 10% increase in gasoline price has the effect of reducing total gasoline consumption by 6-8% and as a consequence, the consumers are gradually choosing not to use relatively fuel-efficient cars that much. In most European countries, fuel taxes are already very high, and increasing them even more would meet with general disapproval.

- **Congestion pricing.** Congestion pricing or peak-period pricing, is a specific pricing scheme that charges car users with compensation for using the road when its capacity is reduced, i. e. during rush hours. The efforts to introduce congestion pricing more widely have, so far, reached only limited success. Until recently, the technology presented an obstacle. The technologies that were needed to implement efficient tolling on high speed and high-capacity roadways have become available only in the last decade. Furthermore, for a number of reasons, citizens and the politicians in most places have opposed the use of pricing for the benefit of restricting driving during rush hour. Congestion-pricing initiatives in Sweden and the Netherlands have likewise met with disagreement. An attempt to implement a congestion-pricing scheme in London has also met with significant disapproval. Nonetheless, there are some indications that the future of congestion pricing is likely to be brighter than the past. Firstly, technology is no longer an obstacle; the development and widespread experience with advanced electronic fare collection mechanisms makes the actual implementation of a congestion-pricing program relatively simpler. Secondly, recently there have been some experiences according to which congestion-pricing schemes have been successfully introduced without much opposing. Politically, the best prospects for wider adoption of this strategy appear to be in connection with the introduction of new roadway facilities, where the tolled facility offers a high level of service alternative to older, unpriced, competitive facilities.

(2) Introducing innovations to increase the operational and economic efficiency of public transport.

There is a number of initiatives that promise the increase of operational and economic efficiency of public transport systems. Some are based on technological developments, such as the use of smart cards; some on the development of real-time passenger information systems that immediately inform passengers of the delay in the system's extensive use of automatic bus location systems based on Global Positioning Satellites (GPS-based). The others are based on dynamic scheduling and routing of para-transit to meet excess demand or make up for delays. Still, other innovative operational initiatives include door-to-door public transportation service. Other initiatives involve more vigorous and imaginative management by public authorities and institutions. These initiatives include an increase in track sharing, i. e. joint use of mainline rail lines by intercity, regional, and municipal public transport systemwide; regional integration of public transport schedules and fares; the development of regional transportation associations. Among the most important global trends in public transport management are efforts to improve the economic viability and efficiency of public transport by putting

the operation of public transportation systems into the hands of the private sector. Known in its various forms as a deregulation, privatization, outsourcing, contracting, franchising or competitive tendering, it always aims for the same thing: to improve the service quality and performance of public transport by adding competition and entrepreneurial approaches into delivery service.

(3) Improving the Available Transport Options

Planners suggest two strategies to facilitate sustainable mobility in the category of improving the available transport options. Firstly, to reduce car dependency by increasing non-car transport options. Secondly, to provide mobility and accessibility options for those who do not have access to cars.

- **Provision of public transport**. In the last three decades, the cities of the developed world have significantly improved their public transport. In the EU, the bus and coach fleet has steadily grown and is now 50% larger than in 1970. There has also been an expansion in urban rail in the last quarter of the XX century, with new systems constructed in a number of European cities. Although these improvements in the provision of public transport have been accompanied in most cases by increases in absolute levels of patronage, public transport's share of total trips and total kilometers traveled has actually declined almost in the entire developed world during this period.

- **Improving non-motorized transport (NMT).** Among the EU countries, Denmark and the Netherlands are the leaders in promoting NMT. Dutch Traffic and Transport Structure Scheme (SVV2), covering the period from 1990–2001, identifies the bicycle as the ideal means for trips of up to 5–10 kilometers. In fact, 40% of all car trips in the Netherlands are less than 5 kilometers long.

At the same time, the SVV2 recognizes a number of issues associated with bicycle use, including the need to provide direct, safe, and attractive bicycle routes between residences and trip destinations; the need to provide bicycle parking facilities; and the problems of safety and bicycle thefts. Within the framework of the SVV2, the government developed a national Bike Master Plan (BMP), according to the data from 1990–1997, to promote and improve bicycle use. Roughly 575 million guilders (US$230 million) were spent by central, provincial or local government on bicycle projects. Despite this substantial public investment, BMP research concluded that bicycle policy alone was not sufficient to increase bicycle use and restrain growth in car use. Denmark has some of the most aggressive pro-NMT policies in the world. Copenhagen has approximately 300 kilometers of separated bicycle tracks, which is about half the total length of the city's road network. Bicycles are given priority over motorized vehicles at intersections, and a public education program includes a "culture of respect" for pedestrians and bicyclists by drivers. Such initiatives have resulted in Copenhagen's having one of the lowest rates of transportation-related fatal accidents per person in the world (1.3 deaths or serious injuries per year per thousand residents). Copenhagen also runs a City Bike Program, which in 1997 provided roughly 2,500 free bikes at key locations around the city. The bikes are refunded by advertising, and are maintained by the Municipality, with the help of the prison inmates. There are plans to increase the number of bikes in the program. Copenhagen has also taken measures to make the use of cars undesirable. For example, it has reduced the availability of parking and converted streets to pedestrian zones. At the national level, car ownership in Denmark is discouraged through very high vehicle registration fees (105-180% of the vehicle purchase price), although the gasoline tax is in the middle of the range of European rates. Roughly, one-third of the city's home-to-work trips are made by bicycle.

- **Providing transport options for those without cars**. There are many programs and policies to provide mobility for those without access to car. Effective solutions frequently focus on particular groups, such as the poor, those with disabilities, or the elderly. Policymakers particularly focus on three kinds of strategies:

- *Ensuring that mainline public transport services are sensitive to the needs of those without access to cars*. Agencies often provide minimum levels of public transport service apart from rush hour, to ensure that service is available or, even when such service would not be justified on strict economic grounds.

- *Para-transit services*. In several regions, there are trips that conventional public transport is unable to provide. In many cases, local authorities provide demand-responsive para-transit services in order to help people with special needs. Such programs are often targeted at the disabled and the

elderly. These services have both advantages and disadvantages, depending on conventional public transport. Being demand-responsive and door-to-door, they often offer a high level of service, and as a result there is disagreement about what constitutes fair and efficient pricing for the service. On the other hand, these services usually require significant planning in advance. Moreover, many disabled citizens argue that, for dignity's sake, they deserve to be integrated with mainstream society as much as possible, and being able to use public transport is an important element towards this goal. Many disabled citizens and their advocates condemn targeted para-transit services — even those offering higher levels of service than conventional public transport — as humiliating.

- *Direct user-side subsidies* to help those without cars to either get them (when the poor are concerned) or buy alternative transport services (such as taxi service) directly.

(4) Land-Use and Urban Design Strategies

In the last three decades, some urban regions in the developed world have successfully employed land-use policy to facilitate a pattern of development by which public transport can play a significant mobility role, and limit sprawl. This policy encourages residential, employment, and recreation buildings to cluster around rail public transport stations. The goal is to build compact, pedestrian-friendly communities where many trips could be made on foot or by bicycle, and train could make longer trips. This approach has been followed widely and successfully in Europe. Examples include Stockholm's satellite towns situated along travel rail lines which spread from the city; French "villes nouvelles" on the outskirts of Paris and German transit-oriented suburban communities such as Munich's Perlach and Frankfurt's Neustadt.

The Netherlands, one of the smallest developed nations in Europe, has a comprehensive approach to land-use planning - the ABC policy. Dutch planning focuses not only on restricting traffic growth and urban sprawl, but also on developing compact cities and protecting open areas. ABC explicitly seeks to reduce auto mobility through programs such as the one summarized in its slogan for business location: "the right business in the right place". The ABC policy classifies businesses into three categories based on the importance of their need for public access and road transport. Business development sites are classified in the similar way, in terms of their public transport and road accessibility. The policy attempts to encourage business with a large number of employees and visitors which is located on sites with good public transport accessibility, such as near centrally located public transport or rail stations ("A" sites) or near major public transport modes in less central locations ("B" sites). "C" sites, with good road access, are primarily intended for the business that depends on road transport for its operations. Associated with each type of site are restrictions on the number of parking spaces that can be provided there: "A" sites are limited to 10 to 20 parking spaces per 100 employees and "B" sites to 20 to 40 parking spaces per 100 employees. These rules are restrictive enough, and as a result the businessmen have a strong objective to locate their business in accordance to the intentions of the policy. All in all, the Dutch accept the ABC policy, though objections to the highly restrictive parking limits, along with economic pressures at the local or provincial levels, have led to loosening parking rules in some areas of the country.

(5) Integrated Approaches

The most successful examples of cities controlling auto mobility and improving the sustainability of their transport system use combinations of the policy options above. Isolated policy responses are not likely to have a significant impact. Copenhagen, for example, combined public transport-oriented land-use planning, high car ownership charges, priority treatment of bicycles, and numerous improvements to city center social life. Zurich upgraded its tramways into a modern, high quality, and reliable public transport system operating on separate rights-of-way, obtained by removing traffic lanes from general use. A computer-based signaling system ensures that trams do not have to stop at intersections. Intensive marketing and information campaigns promote the use of the tram system, and special maps show people how to get to particular destinations such as restaurants and cultural attractions via the public transport system. These public transport system improvements were accompanied by corresponding land-use and urban improvement policies. Large shopping centers were built around major stations.

1. FACTS ABOUT SERBIA

1.1 Geographical location

The Republic of Serbia is the integral part of the state union Serbia and Montenegro. It is situated in the southeastern part of Europe, in the Balkans.

The total territory of the Republic of Serbia is 88,361 km^2, and it is distinguished by three areas with different territorial characteristics:

- Vojvodina, is a plain in 21,506 km^2
- mid-part, which is a mixture of lowland, hills and mountains in 55,968 km^2, and
- Kosovo and Metohija – a mixture of hills, mountains and valleys in 10,887 km^2.

According to its geographical location, Serbia is:

- Danubian country – the middle course of the Danube flows through it
- Balkan country – it is in the middle of the Balkan peninsula
- South-European country – it is very close to the Adriatic sea, and its access to the sea is through Montenegro, whereas the valley of the Morava and Vardar connects it to the Aegean Sea

1.2 Traffic location

Located in the Central Balkan, Serbia links Europe and Asia with naturally created river valleys, easily surmountable and adjustable traffic corridors. The outline of Serbia's geographical and traffic location is made of inadequately coordinated and synchronized systems:

- waterways
- international transportation main roads (TEM), i. e. fully- profiled highways and half-profiled highways (E-75, E-70, E-80, E-65)
- international railway
- airline and airports for international air traffic.

In the part that follows, we have taken a detailed look into five towns in Serbia: Belgrade, Novi Sad, Subotica, Kragujevac and Niš.

- Belgrade


Parliament of Serbia and Montenegro

Belgrade stands at the crossroads of Eastern and Western Europe, in the Balkans. It lies at the mouth of the Sava and Danube and it is surrounded by water on three sides. Belgrade is one of the oldest cities in Europe and, besides Athens, it is the largest urban entirety in the Balkans.

Belgrade is the capital of Serbia and the administrative center of the state union of Serbia and Montenegro, with approximately 1.7 million citizens.

Latitude of Belgrade is:

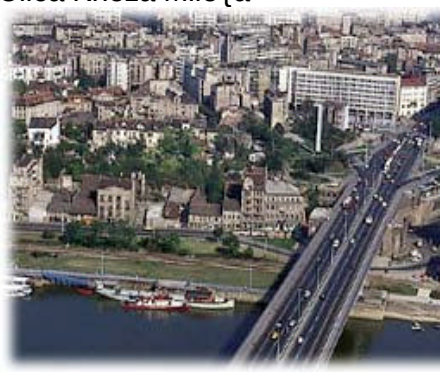
- **44^{0}49'14"** southern latitude,
- **20^{0}27'44"** eastern longitude,
- the average altitude is **116.75 m**.


Ulica Kneza Miloša

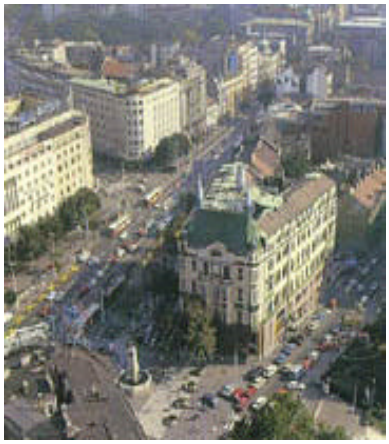
There are two natural entireties in the surrounding of Belgrade:

- in the north there is the Panonian depression on wheat and corn, and

southwards from the Sava and Danube, there is Šumadija on orchards and vineyards. The most distinctive parts of the relief in Šumadija's hilly terrain are Kosmaj (628m) and Avala (511m).


Brankov most

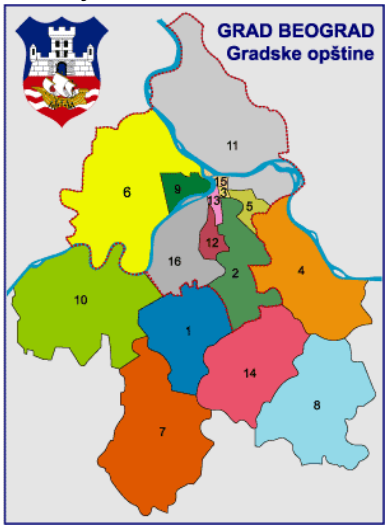
The great distinctiveness of the relief in Belgrade southwards from the Sava and Danube, makes the city spread across many hills. The highest elevation in the closer surrounding of Belgrade, is the Holy Trinity church in Torlak (Vождovac), which is 303.1m high, whereas the lowest elevation is in Ada Huja with 70.15m.



Terazije

The perimeter of a wider city territory is 419 km. The greatest distance in the northeast direction is 92,98 km, and in the east-west direction it is 67,50 km.

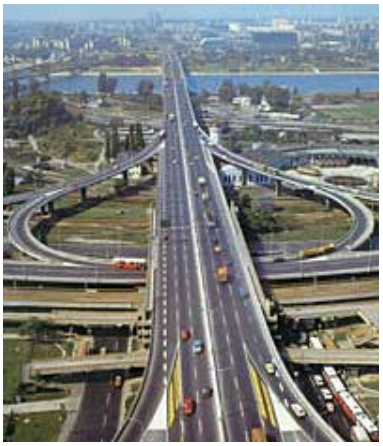
The city spreads over 3.6% of the whole territory of Serbia. 15.8% of the whole population of Serbia lives in Belgrade and 31,2% of the whole number of employed people work here. Belgrade has the status of a separate territorial unit in Serbia, with its own autonomous city government. The narrow area of Belgrade, the urban part, takes up 36 km^2, and the total territory of the city is 322 km^2.



The municipality of Belgrade is divided into 16 smaller municipalities:

- 10 city municipalities (Cukarica, Novi Beograd, Palilula, Rakovica, Savski venac, Stari grad, Vožd ovac, Vracar, Zemun and Zvezdara),
- 6 suburban municipalities (Barajevo, Grocka, Lazarevac, Obrenovac, Mladenovac and Sopot).

Belgrade is a very significant point when traffic is concerned, as an important road and rail junction, as well as an international river and airport and a telecommunication centre.

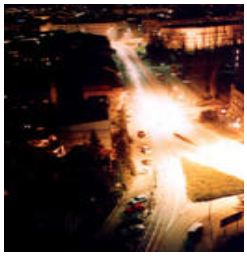


"Mostar" interchange on the highway through Belgrade

Buses at the Republic Square, one of the bus loops in Belgrade

- **Novi Sad**

Novi Sad is situated between the 19th and 20th degree of eastern longitude and between the 45th and 46th degree of northern latitude. It is in the southern part of Panonian plain, taking the most part of South Backa at the altitude of 72-80m. Novi Sad is on the left bank of the Danube, or more precisely at the 1255th kilometer of its waterway. Novi Sad also stands at the mouth of one of the main channels Danube-Tisa-Danube and Danube. This channel flows into the Danube at its left bank in Backa.



Novi Sad, with all its suburban areas, counts 20% of the whole population in Vojvodina. This is the second biggest town in Serbia and Yugoslavia.

Novi Sad is one of the biggest economy and cultural centres in Serbia. It is unusual, an attractive match of old Serbian spirituality, Austro-Hungarian cultural heritage, southern beauty and northern elegance. A town by the river, with a mountain in its background, surrounded by fertile plough land and famed vineyards, the town with valuable tradition and cultural legacy is really a town made to measure a man.

Novi Sad is on the way to Budapest and Vienna, or on the way to Thessalonica, Athens, Bukurest and Istanbul. Highway E-75 (Budapest-Belgrade-Niš) passes by Novi Sad and highway E-70 is very close to it.

- **Subotica**

Town hall from above

Subotica is the most northern town in present Yugoslavia, and the second largest town in population in the Autonomous Province of Vojvodina. It is situated 10 km away from the Yugoslav-Hungarian border, at 46°5'55" of northern latitude and 19°39'47" of east longitude.

Grammar school building

This town lies in the heart of Panonian plain. It has long tradition and rich cultural heritage. Apart from the town, the municipality counts 18 more suburban settlements, and the whole territory is 1008 km^2 large.

Part of the promenade

Thanks to its geographical location, over the years, Subotica became the most important administrative, industrial, trade, traffic and cultural center in the northern Bačka. Palić lake near the town makes it an interesting tourist and recreational center of a wider area.

- **Kragujevac**

Kragujevac is an economy, cultural, educational and political center in Sumadija and Pomoravlje. It is in the middle of the Republic of Serbia and it counts 180,000 inhabitants. If you take E-10 highway and head southwards, Kragujevac is 140 km away from the capital of FR Yugoslavia.

Kragujevac has long tradition in industry. The main products produced there are: cars, transportation vehicles, weapons for sports and hunting, transporters, ready-to-wear clothes, foodstuff, etc.

This town is a significant educational center as well.

Apart from the well branched system of roads which connects Kragujevac with many towns and suburban areas, the railway from Kragujevac leads into four directions:

- Kragujevac-Belgrad-Subotica-Budapest
- Kragujevac-Niš-Sofia
- Kragujevac-Podgorica-Bar (sea port)
- Kragujevac-Skopje-Thessalonica (sea port)

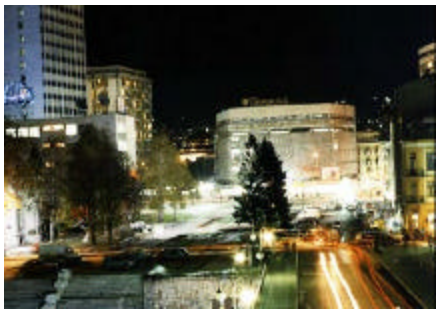
Sea transport is organized through Bar port, using Kragujevac-Bar railway (450 km), and river transport goes through Smederevo port on the Danube. It would be possible to organize sea transport even through the Thessalonica port in Greece by using the railway.

Air transport is organized through “Surcin” airport in Belgrade.

- **Niš**

Niš is one of the oldest towns in the Balkans. It is the domicile of Niš region and is situated at the crossroads of Balkan and European roads, which connects Europe with the Near East. From times immemorial Niš is recognized as the gate between the East and the West.

Niš is placed in Niš valley, at the mouth of the Nišava and the Južna Morava, at 43° 19' of northern latitude and 21° 54' of eastern longitude. The town territory takes up 596.71 km^2 and apart from Ni{ there are also Ni{ka Banja (Ni{ health spa) and 68 suburban and village settlements.



Geographically, Ni{ stands at the crossroads of major Balkan and European traffic directions. The direction of the main road coming from north, through Belgrade and going along the Morava, branches in Ni{ towards the south (along the valley of the Vardar to Thessalonica and Athens) and east (along the valley of the Ni{ava and Marica to Sofia, Istanbul and further on towards the Near East).

Furthermore, Ni{ separates the roads to the northwest (towards Zajecar, Kladovo and Timisoara) and southwest (towards the Adriatic sea). All these directions were known ever since the ancient times as the roads used by migrating populations, armies and traders."Via Militaris" in the period of Rome and Byzantium, "Carigradski drum" in the medieval times during the Turks reign.

Today, these are the major European directions in the Balkans, making Ni{ the crossroads of Europe and Asia Minor and the crossroads of the Montenegrin sea and the Mediterranean.

As an important junction of European roads and rails with the airport, it is easily accessible from all directions. As a modern university town, it is also the social, economy, educational, health, cultural and sports center of the southeastern Serbia.

Ni{ is one of the major industrial centers in Serbia and Montenegro. The leading companies in electronic, mechanical, tobacco, textile and other industries are situated in Ni{.

1.3 Key problems

On the international scale, in the last ten years traffic system in former Yugoslavia began to disintegrate. Belgrade was the most important point in that system. Reduced market and a drastic drop of production have directly been reflected on the decrease of intensity and quality of service with every type of traffic. In such conditions, the process of disintegration of national traffic system transferred to the area of Belgrade as well as to other smaller towns. Today, the undefined strategy and absence of unique policy of handling traffic, lack of functional and technological correlation of different types of traffic, bad condition of traffic infrastructure, old-fashioned means of transport and facilities that control and handle traffic, present the main defects of the traffic systems in Serbia on the regional scale as well as on the local (town) scale.

The degree of development and construction of the street network is one of the basic indicators of the state of traffic system development. With the rise of motorization, or the increase in use of cars, which is a growing tendency, the street network in most Serbian towns nowadays is such that it will not be able to take the increased volume of traffic.

Traffic congestion problems and parking problems grow rapidly. Because of the out-of-date traffic control systems, the delays are longer than they should be. Traffic arteries are in a very bad condition, because the volume of traffic has increased and means for maintaining have reduced. The number of car accidents has reached an alarming level. Transit traffic ways go through city streets because there are not enough bypasses and highways.

During the first years of transition period, public transport became more expensive, whereas the service was becoming worse. The car pool was getting older as well, because of untimely replacement and improvement of busses, trolleys and trams. Having no priority in traffic, public transport vehicles also experienced the problems of traffic congestions. However, with the rise in ticket prices, the initiative to improve public transport and its performances also grew.

Side effects of using motor vehicles are air pollution and noise. The car pool here is much older than in the western countries, people here use super petrol more than the lead-free petrol and diesel petrol contains more sulphor than it is the case in the West.

City authorities have faced a difficult and obviously contradictory challenge. On one side there was the request for lowering ticket prices and improving public transport, and on the other side there was even a bigger pressure to use scarce public funds for improving and constructing new traffic arteries and for increasing parking lot spaces in order to reduce traffic congestions.

Four key problems in towns in Serbia, that we are going to discuss here now, are:

1. Traffic congestion and parking problems
2. Public transport deterioration
3. Safety of pedestrians and cyclists
4. Ecological consequences of the development of road traffic

1.4 Urban structures

The towns that will be analyzed in this project can be divided in to three categories:

- metropolis, with a population of more than 1,000,000 inhabitants: Belgrade
- large towns, with a population between 200,000 and 300,000: Novi Sad and Niš
- medium-sized towns, with a population of 100,000 and 200,000: Subotica and Kragujevac

Table 1. Analyzed towns in Serbia

Town	Population	Territory (km^2)	Population per km^2	Road network length (km)	Length of public transport route (km)
Beograd	1.602.226	3224	497	1527	1380
Novi Sad	265.464	699	380	370	
Subotica	150.534	1007	149	408	73
Ni{	247.755	597	415	379	
Kragujevac	180.084	835	216	410	

From the above-mentioned towns, Belgrade is the capital, whereas the other towns are typical representatives of larger towns in Serbia. These towns have a leading role in the economy of the state, in its cultural and social life. Regarding the fact that towns in Serbia, as well in central and Eastern Europe, were not prepared for economy and political changes, they faced problems in traffic, urban development and in ways of exploiting land.

Table 1 gives a list of chosen towns with information about number of inhabitants, territory, population density, length of road network and public transport routes. All towns except Belgrade use buses for public transport were as Belgrade in its transportation system has buses, trams, trolley buses and regional railway. Representatives of municipalities are aware of the urgency to renew car pool, tram rails, and to improve systems for handling traffic. Applying key elements of sustainable development should do all this.

Although the length of traffic arteries in these cities is satisfactory, the traffic may face a breakdown firstly because of bad street system, insufficient capacity of traffic arteries, out-of-date systems for handling traffic, bad public transport and even worse parking conditions. With the rise in degree of motorization, and even in a case of a slightly increased degree in using cars (which is quite common today), condition of street network is such that it will not be able to accept all the requirements of transportation system. Investing into renewal of town roads is another priority in many municipalities.

The biggest problems of traffic in towns today are:

- declined or pore quality of public transport such as reliability, comfort, working hours, ticket prices
- insufficient capacity of the existing traffic artery system
- lack of car parks in city centers
- insufficient financial investments in reorganization of parking handling and improvement of public transport
- increased air pollution and new noise level from traffic
- out-of-date systems for handling traffic lack of traffic information system and handling system.

1.5 The degree of motorization

Table 2. A survey of the degree of motorization in the surrounding countries

Country	**Degree of motorization**. (PA/1000 inh.)
Greece	223
Hungary	238
Romania	106
Bulgaria	204
Croatia	175
Yugoslavia	145
FYROM	141
Austria	458
France	438
Germany	498
Italy	568
Czech	324
Poland	208
Slovakia	196
Slovenia	365

(source:IRF World Road Statistics 1998)

Table 3. The degree of motorization (car/1000 inhabitants) in regions in Serbia

Serbia	**Vojvodina**	**Mid Serbia**	**Kosovo**
137	164	157	51

Compared to the Western European towns, such as Berlin (east area: 302 cars per 1000 inhabitants; west area: 346), Hamburg (500), Munich (570), it is clear that the degree of motorization in towns is much lower and could be expected to rise in the next period.

We should mention here that owning a car in Serbia, as well in the whole CEE, became a status symbol and symbol of freedom. This caused a great demand for cars that, because of the financial status, would be bought as used cars. These used cars come from Western Europe, mostly from Germany and Scandinavian countries. This mass import of used cars, caused many problems in traffic, such as noise and air pollution.

The average period for a car in Serbia to be used is 13 years, which means that there are a significant number of cars older than 20 years in traffic. The average period for Belgrade car pool to be used is 14.8 years. This means that the vehicles in streets and roads are not safe and are a potential danger for people and the surrounding. Serbia is among European countries, which have the highest rate of traffic accidents, as well as for the number of injured and killed. Many of these accidents were caused by pore technical condition of vehicles. Moreover, vehicles have negative effect on the surrounding by issuing exhaust gases, spilling oil and causing noise. For all these reasons, the use of large number of vehicles is

restricted only to Serbia. The consumption of petrol, lubricants and other expendable materials, is 30% bigger than with modern vehicles (produced in the second half of 20th century). On the other hand, sections for maintaining public transport car pools are at a technological level of the beginning of the 20th century. Maintaining costs are enormous, even higher than the installments and maintenance of new cars.

While assesing the degree of motorization, we should bare in mind that it varies from country to country and from city to city depending on city structures, acessability to public transport and cultural situation of the region. It is clear that the degree of motorization and volume of traffic in cities grows rapidly, maybe even more rapidly than it has been predicted. Municipalities that realized this quickly, started to apply certain measurea by investing in roads, parking lots and public transport.

1.6 Modal split

Modal split is another element which describes general situation in traffic in the analysed towns, i. e. the choice of population while chosing different modes of transport, such as public transport, cars, cycling or walking.

Table 4 Modal split in towns

Municipality	Belgrade	Novi Sad	Subotica	Ni{	Kragijevac
Public transport	50		16		19
Cars	20-25		20		26
Pedestrians & cyclists	20-30		648		55

Generally speaking, the share that using cars take in the modal split in towns in Serbia, is somewhere between 20-30 % and it is less than the share of using cars in Western European towns (Amsterdam-35%, Bremen-40%, Esen-53%, Hamburg-45%, Stockholm-37%).

The share of using public transport in Serbia is large, especially compared to Western European towns (where it is 24-40%). The share of using public transport also depends on how big the town/city is. In smaller towns walking is predominant.

The share of using bicycles in the selected towns takes 20-30%. The share of walking and using bicycles in Western European towns also varies from town to town and depends on the town structure, relief, climate, habits and culture.

2. PARKING MANAGEMENT

The towns in question have cultural and historical centers that are important traditionally for commercial, social and cultural activities. Such town centers are adjusted to different modes of functioning, but the streets are too narrow for increased traffic volume. Because of this the parking problem has become more serious. Town authorities will have to introduce new parking limits, such as limited access to the centre of town for employees that use cars, and limited hours of staying in central areas of towns, such as has been done in many cities in CEE.

Parking problem in towns is becoming more and more serious as the volume of traffic began to increase. Main parking problems in towns are:

- ineffective control and implementation of laws when parking tickets are concerned
- illegal parking on pavements and green surfaces
- lack of well organized parking, insufficient number of open car parks, underground and ground-level garages
- low incomes, because of unpaid parking tickets
- division of responsibilities in local town authorities
- non-existence of the universal parking system for the whole town

One of the main characteristics of Belgrade nowadays is that it does not have parking spaces in the center of the city. Belgrade city center has never had this problem properly solved. Few garages that were built during the 80s were not enough even for the period they were built in, let alone for the years to come. Moreover, when building new parking lots, it never meant the real obligation for the cars to be parked at that exact spot. There was no real intention even to charge car-owners for the parking space if they did not use their own garages or parking spaces. During the 90s, these inherited problems became only worse. The need for parking spaces today goes way beyond the offered capacities. Depending on the parking locations in the central area of the city, the distribution of parked vehicles shows that only 8% of vehicles is parked in garages, 2% is parked in open parking lots and 90% in the street.

Table 5 Number of parking spaces in towns

Municipality	Beograd	Novi Sad	Subotica	Niš	Kragujevac
Charged street parking			850		
Free street parking			2500		
Street parking as a whole			3350		
Closed garages			0		
Open car parks			1200		
Street and off-street parking as a whole			4550		

While assessing the need for parking spaces, the right number of parking spaces should be well balanced, so that the valuable city space does not get occupied with parked cars or that the attitude of population does not change towards using public transport.
The way in which the parking is charged depends from town to town. In some towns the charge depends on the period during the day, there is a period when parking is more expensive and, then again, the period when it is not. In other towns the charge depends on the parking location. In such cases, parking in the centre of town is more expensive than parking in suburbs. And in other towns, again, this charge depends on the period of day as well as on the location. The charge can depend also on the time for which the parking space is going to be occupied: short-lasting (up to 2 hours) and long-lasting (up to 6 hours). Then, the charge for the long-term parking is slightly lower. Moreover, some towns provide daily, sesonal or annual subscriptions on parking spaces for employed people using cars to get to work.

From the above-mentioned facts, it is obvious that there is a wide span of measures, which can regulate parking. They are:

- charging for the parking space for an hour or half an hour
- charging for the parking space depending on the location
- charging for the parking depending on the time for which the space will be occupied (limited short-term occupation period, limited long-term occupation period and unlimited occupation period)
- rise or fall of the parking prices depending on the occupation period
- charging for the parking depending on the workin g hours of a company/firm
- charging for the parking space much more than the price of a bus ticket is.

Responsible people in the town authorities in Serbia have become aware of the need to undertake first steps in dealing with this random parking. Increased level of control and more efficient implementation of laws, is the key element for improving the existing system. Charging for the parking spaces more efficiently, would increase financial funds for buying better handling parking equipment. Parking would, thus, become more efficient. Parking limitation measures should be spread from the very centre of town to the areas surrounding the centre. Private parking by the residents of central areas in towns must be well managed as well, and the same thing stands for the people who work in central areas. All these measures and activities are the basis for making universal charts for handling traffic in towns.

3. PUBLIC TRANSPORT

Public transport and walking are the main modes of transport in towns in Serbia. Although the degree of motorization is increasing, public transport still plays the main role in the mobility of population in towns. On the other hand, public transport corporations have faced the pressure of boom, decreased subsidies and new obligations of reconstructing and reorganizing.

These processes require exceeding the former ways of handling public transport corporations and improving their organization. Furthermore, car pool and technical support for the vehicles must be renewed. Apart from all the problems mentioned above, public transport corporations also face with the following:

- ramified route system for public transport which is difficult and expensive to maintain, especially tram rails;
- old and decayed vehicles that are expensive to maintain;
- abatement in the quality of services, such as reliability, speed and frequency;
- lack of signaling system which would provide priority for buses and trams;
- restricted subsidies and insufficient funds from ticket revenues;
- insufficient funds for rehabilitation and maintenance of the complete public transport system;
- traffic congestion caused by increased volume of traffic.

From all the analyzed towns, all of them, except Belgrade, use only buses for public transport. Belgrade has buses, trolleybuses, trams and city rail. Public transport in Belgrade is conducted through a public corporation “GSP Belgrade” and some 100 more private transportation corporations. Private corporations were included in the public transport system in 1998. “GSB Belgrade” owns a car pool of 757 buses, 206 trams and 124 trolleybuses, whereas the private corporations together handle 620 buses, from which 60% operates in the rush hours.

Suburban traffic is also handled by the “GSB Belgrade”, then “SP Lasta A. D.” and “Beovoz” (operating within the “Yugoslav railways”), as well as by a number of private corporations. At the territory of Belgrade, traveling by railway is done in three routes, the length of all three being 100 km. There are six electric motor trains with the capacity of 600 seats each.

The following tables show the length of the public transport routes and the number of vehicles.

Table 6 Length of the public transport routes in km

	Bus	Tram	Trolleybus	City rail
Belgrade	1248.40	122.15	56.80	102.60
Novi Sad				
Subotica	73	/	/	/
Niš				
Kragujevac				

Table 7 Number of public transport vehicles in types

	Bus	Tram	Trolleybus	City rail
Belgrade	757 (620*)	206	124	6
Novi Sad				
Subotica	30			
Niš				
Kragujevac				

* private transportation corporations

It is well known that public transport vehicles are in poor condition and need a renewal right away. In the countries of CEE, the average age of a vehicle is between 15 and 20 years, while the age of the car pool in Serbia is presented in the following table:

Table 8 The average age of the car park

	Bus	Tram	Trolleybus	City rail
Belgrade				
Novi Sad				
Subotica	10			
Ni{				
Kragujevac				

It is considered that an operational period of a bus should be 10 or 12 years at the most, whereas the operational period of a tram is 30 years at the average. Because of this variance in operational periods of different vehicles, the options of rehabilitating buses are also versatile. For example, trams, which operated for 10 years, could be maintained and used again for another 16 years.

One of the major problems for buses and trams operating in towns in Serbia is that there is no signaling system for giving priority to public transport vehicles at crossroads, as well as non-existence of separate traffic lanes. Implementing such measures would surely improve the quality of transport, which is much more economical than renewing car-pools.

4. SAFETY OF PEDESTRIANS AND CYCLISTS

In towns of the Central and Eastern Europe, the number of travels by walking is between 1/4 and 1/3 of the general modal split. Generally speaking, this is also the case in towns of the Western Europe. When combined with public transport, walking is very significant for the mobility of population in towns.

Pedestrians *play the second fiddle* to other participants in traffic. The requirements of the pedestrian zone are underestimated and they are given secondary importance. Motor vehicles have priority in towns and pedestrians are forced to cross busy multi-lane motorways, to use underground passages, while moving on the pavements does not satisfy the minimum of requirements. In that way, pedestrians are squeezed on narrow pedestrian lanes and pavements, while the motorways are constructed for secure and swift flow of motor vehicles.

Pedestrian traffic is currently even more aggravated, because pedestrian surfaces are now occupied with parked cars, kiosks, street stalls, restaurants and cafes, etc.

The number of travels by bicycles in the Central and Eastern Europe is estimated to 1-3% form the whole distribution, and generally speaking, using bicycles is much less common than in the towns of the Western Europe. Such a small number of bicycle travels is caused by many reasons: climate, tradition, social values and lack of infrastructure.

Traveling by bicycle is becoming more and more common in the traffic structure in Serbian towns. The conditions for such a mode of traffic in the streets of limited capacity, are quite restricted, because the streets are used for individual, public, freight, pedestrian traffic and parking at the same time. That is why this mode of transport needs appropriate attention through regulatory measures, as well as through the construction of separate bicycle paths.

The trend in bicycle traffic, which is present in Europe in the last few years, is present in Belgrade, too. This is partly so because of the successful publicity which instigated its development. In the last 10 years, 20 km long bicycle paths have been, made in Belgrade. However, for more intensive use of bicycles as means of transport (not only for recreational purposes), Belgrade would need a much more ramified network of bicycle paths, changes in traffic regulations, as well as improvement in attitude of drivers when accepting cyclists as equal participants in traffic.

The most significant problems of pedestrians and cyclists are:

- irresponsible and arrogant behaviour of drivers;
- poor condition of pedestrian and cyclist infrastructure;
- disregard of traffic rules and regulations;
- lack of compulsive measures for disregard of regulations referring to drivers, cyclists and pedestrians;
- lack of pedestrian crossings and infrastructure, such as traffic lights and signs

- pedestrian surfaces, such as pavements, parks, playgrounds, are jeopardized by the parked cars;
- commonly accepted view, from the traffic experts to policemen, that “the car is the first”.

To improve the conditions for mobility of pedestrians, we can free public spaces from parked cars and allot kiosks, restaurants, cafés and street stalls, which take up space assigned to pedestrians. Thus, pedestrian lanes would appear more attractive, more secure and appropriate for those with special needs (parents with children, older population, disabled persons, etc.).

The development of pedestrian surfaces should not be limited only to spaces with commercial function, but also to spaces with cultural, monument and historical function. When planning pedestrian communications in towns, above all the aims are to increase the security of pedestrians, as well as to provide comfort and satisfaction with certain ambience for pedestrians. Pedestrian zones do not anticipate typical solutions, with a complete prohibition of motor traffic, but each potential location is appraised according to its own characteristics. The conditions for setting up normal pedestrian traffic will be created only after the parking problems in central town areas and other attractive places are solved.

The planned bicycle lanes should go along the main pedestrian trajectories, they should use “quiet streets” and avoid parts of towns with slopes. They should also pass along green surfaces and they should connect places of residence, places of central activities and places used for recreational purposes.

Being unsafe in the city streets, because of the lack in infrastructure and traffic regulations, is one of the major problems that cyclists are faced with. The following tables present the share that cyclists take in modal split of the analyzed towns. There are also some data about the bicycle accidents.

Table 9 The share that cyclists take in modal split

Belgrade	Novi Sad	Subotica	Niš	Kragujevac
		25		

Another way of improving the conditions for pedestrians and cyclists is to build up awareness of drivers and make them realize that non-motorized vehicles are as equal participants in traffic as motorized. Such an attitude of drivers could bi understandable, because constructional measures are, in most cases, subjected to motorized traffic (extra lanes and new parking spaces are being built). This kind of opinion leads many people to the conclusion that mobility is equated with automobile traffic.

5. SUSTAINABLE URBAN TRANSPORT – REDUCTION IN THE USE OF ENERGY, AIR POLLUTION AND LEVEL OF NOISE

The use of energy in Serbia can be improved in 30-40% by introducing new technologies and contemporary handling systems (new engines, traffic arteries of a better quality, more qualitative traffic handling). The use of energy is much bigger in Serbia than in other more developed countries. Reasons for this are the following: out-of-date car pools, inappropriate traffic handling systems, insufficiency of parking spaces, poorly developed systems of public transport and other alternative modes of transport in most towns, condition of road network, condition of the equipment, etc.

The major ecological problems in Serbia are caused by the situation in traffic:

- the vehicles that are used are relatively serious pollutants of the environment;
- old vehicles have old engines which produce exhaust gasses, noise and waste materials;
- vehicle maintenance sections usually operate under out-of-date technologies and also pollute environment with waste materials;
- recycling of waste materials, especially the recycling of unusable vehicles, is not being applied at all;
- number of accidents is extremely high owing to the poor condition of the traffic system;
- a great number of inhabitants live in areas with the level of noise over 65 dBA

6. PRIORITIES OF TRAFFIC MANAGEMENT IN TOWNS

In the previous section, we focused on four special areas of urban transport:

1. **Improvements parking management**
2. **Renewal and reconstruction of public transport**
3. **Increase of security for pedestrians and cyclists**
4. **Reduction in the use of energy, air pollution and level of noise**

Since these four subjects have been discussed separately, it should be emphasised that thay are quite connected and should be united in a unique transport policy.

6.1 Improvements parking management

Many towns in Serbia already started to improve Handling Parking in central town areas. In the future period, the parking policy for the territory of the whole town should be defined and thus produced solutions and balanced consequences of the limited movement of cars in the central areas of towns.

The key questions for town authorities on the parking handling are:

- **More effective penal policy**
  Better control and more efficient penal policy should refer to the current and the future handling of street and off-street parking. The following measures should be applied:
  - increase the number of people who will do the control
  - allow access to certain areas only through the payments/tickets

  In order to improve penal policy for handling traffic, it its important not to create the atmosphere of “police state”. More effective parking penal policy will also give priority to the needs and wants of pedestrians, inhabitants, cyclists and it will increase their safety in traffic.

- **Controlling street and off-street parking**
  Controlling street and off-street parking is of a special importance in view of dilemmas about the number of parking spaces. There is no specified number of parking spaces, which could depend on the territory of a town.

  However, current parking plans may require certain adjustments to the needs of different towns. Such adjustments are:
  - fine coordination of the existing parking plan and new findings and aims in order to meet with local needs and wants
  - paying more attention to non-residential parking (i.e. parking by business buildings), to the number of anticipated parking spaces when constructing new business premises, to introduce standards fro limited number of parking spaces.

- **Rationalization of the decision process**
  For the successful development of further parking policy, the town needs to include all relevant subjects. For the long-term parking strategies to be successful, it is needed to:

  - form partnership of town authorities, representatives of business associations and citizens;
  - use the temporary universal research, such as the capacity of the traffic arteries, disposability of public transport, the existence of free space, number of current parking places and the assessment of the newly generated traffic by a carefully planned construction;
  - design a model which would simulate traffic and which would be based on the available data; design these models for the city centre and for all other areas of cities/towns in order to have a better look on the requirements for parking places.

  Such effects, with all their advantages and flaws, rationalized and envisaged, make space for decisions and participation of everyone who can contribute to the broad application of parking policy.

- **Operational organization**
  On the organizational level, town authorities can make a contract with a company, which would deal with traffic handling, or they could handle traffic on their own. The town authorities could, in the first place, focus on setting up policies, forming frames for implementing parking policy, etc., than on handling everyday organizational and operational problems.

  It is necessary to invite tenders for parking handling and thus find a company, which would offer a higher level in efficiency in parking handling. It is also necessary to monitor the incomes regularly and define for which purposes this money is going to be spent (eg. on public transport and/or other measures that would provide reduced use of cars).

  The condition in which the parking system currently is, dictates the realization of activities, which should result in the following:

  a) Consistent application of provisions and regulations that define the required number of parking spaces for the objects of specified purpose. These regulations should be considered and put into effect during the planning phase and when preparing technical documentation for the construction.
  b) Spatial organization of the present state: technical organization of parking spaces in the streets with insignificant construction sights and within the valid street width. This should be done with regard to regulations about the choice of the micro location and dimension of parking spaces.

c) Functional organization of the present state which means definition and more efficient application of the parking regime, parking space market, tariff system, system of control and sanctioning parking violations.
   - The parking regime implies the regime of regulating parking periods with the use of tickets.
   - Parking space market: all parking spaces in the areas of great interest should be charged.
   - Tariff system: when forming the tariff system, all categories of users, especially residents, should be taken into account.
   - The system of control and sanctioning parking violations: this system should define types of violations, ways of defining them, ticket amounts and ways of sanctioning them.

d) Constructing off-street car parks and parking garages in the central area of towns, for public use and residents.

e) Integrate the parking tariff system and the public transport tariff system in favor of public transport.

f) Introduce parking regime with limited parking periods in areas of the highest interest.

g) Introduce unique tariff system for the areas closest to the centre of town, which would stimulate only short-term parking in the streets.

h) Effective implementation of the system of controlling and sanctioning parking violations.

The next step would involve construction of parking garages and off-street car parks for the residents, employed people and visitors in the marginal areas of the town centre. These car parks would be constructed on the principle “Park and Ride”, which gives positive results only if the whole complex of parking handling measures are implemented in areas of greatest interest. This system should be implemented in the marginal parts of central areas as well.

“Park and ride” locations should be placed along the terminals, terminus and public transport stops with large circulation of passengers and on the public transport and suburban transport routes with large capacities.

6.2 Renewal and reconstruction of public transport

When we speak about public transport, attention should be paid to the following aspects:

- **Technical aspect**

Renewal and reconstruction of public transport

Renewal of the car pool, mostly buses, is the main requirement and request of a public transport corporation. Of course, the renewal of old buses (eg. Installing

new engines) must be carefully assessed depending on the operational age of that vehicle. On the other hand, buying new buses can be a better solution in case of maintaining costs being smaller in that way, or the degree of air pollution and noise emission by newer buses is smaller.

For the transitional period, it turns out that it is much better to modernize and use used vehicles when trams are concerned, because their operational age is three times linger than with buses. In such a case, the question of whether the renewal of trams is necessary, should also be asked. The advantages of this strategy are the following:

- It is possible to mend the trams in the country, which is from the financial point of view more acceptable;
- Chose the vehicles from the existing car pool whose repair would improve their technical condition much more;
- Supply of used trams could replace the process of mending the existing ones;
- New rams should be bought through the mid-term and long-term programs of car pool renewals.

These measures should be combined with gradual renewal of tram rails and thus provided more comfortable transport by trams. Also, renewal and maintenance of a car pool are a good marketing move for the new and positive image of the public transport corporation.

Giving priority to public transport

In order to improve the condition of traffic infrastructure, most towns urgently need certain engineer measures. Those, quite simple measures, are:

- Renewal of tram rails;
- Introducing new bus routes and making the existing routes longer;
- Separating tram rails and bus lanes from the rest of the traffic wherever it is possible;
- Giving priority to public transport vehicles at crossroads. It could be possible even at the crossroads where public transport vehicles have separate lanes and at the cross roads where there are at least two lanes for one direction. The green phase for public transport vehicles is precisely determined and just quite long enough fro these vehicles to pass the crossroads.

All the above-mentioned measures contribute to the cheaper, more comfortable and more attractive public transport.

- **Operational aspect**

The first step would be the transformation of out-of-date public transport corporations into town corporations which would be more capable of handling both economy and efficiency aspects. Such corporations would be a transitional phase until the complete commercialization is reached.

Denationalization is not a priority, but it should lead to that in a longer corporation transformation process. At this moment, it is important to obtain responsibility, transparency, executive and tax control, which would reduce deficits in corporations, increase incomes, result in cooperation with municipality, find balance between the increased bus tickets and economy needs.

Redesigning the network of public transport routes

One of the key elements in improving public transport quality is redesigning the network of public transport routes. Naturally, redesigning the network of bus routes is much easier than redesigning tram or trolleybus routes. On the other hand, handling public transport system would be easier if the network of public transport routes would be optimized, as well as the timetables, if the volume of car pools would be reduced and if the existing car pools would be used more efficiently.

On the other hand, this process would lead to other positive measures for the users:

- Frequent services during the rush hour and apart from it;
- Better accessibility to public transport stops, as well as better accessibility to the vehicle itself by introducing low-floor vehicles;
- Punctuality and safety when priority signaling system is concerned;
- Reasonable amount of the tickets;
- Maintain the attractiveness and comfort of public transport by introducing contemporary vehicles;
- Integrated tariff system;
- Modes interchanges;
- Better communication with the users through contemporary ITs.

Foreign experience

In countries of the Central and Eastern Europe, foreign experience has proved to be very significant when changing organizational and operational structure. Apart from the collaboration of engineers, other types of cooperation have been employed. These are joint ventures, partnerships with public transport corporations or public transport associations from Western European countries, cooperation concerning requests from international financial institutions, cooperation with NGOs as consultants which would initiate the support of towns in public transport domain.

- **Public transport investments**

Those who bring decisions in municipalities should create clear strategy of the direction of the future public traffic development. Such a context asks for following questions:

- Is it better to handle public traffic through a real commercial company or is it better to keep it within a public corporation?

- Does the process of transformation require certain phases or should it be done all at once?

6.3 Increase of security for pedestrians and cyclists

Municipal authorities should pay more attention to pedestrians, because they take up quite a large percentage in the modal split. Furthermore, pedestrians are the main users of public transport. It is estimated that between 60% and 75% of all travels by public transport is combined with walking. But in spite of that, not much has been done about improving the safety of pedestrians.

In order to increase the safety of pedestrians in towns, municipalities should undertake following measures to reduce suffering of pedestrians:

- Identify "black points" and immediately answer to the large number of accidents involving pedestrians;
- Give priority to the suffering of pedestrians, make it a part of political agenda and reconsider strategies for decreasing the degree of the suffering of pedestrians
- Categorize streets clearly according to their use and type of traffic;
- Make an estimate of the flow and volume of traffic in the streets;
- Make the estimate of pedestrians and cyclists'mobility;
- Adopt a program based on this research and identify areas which would be limited to motor traffic in mid-term and long-term programs;
- Organize campaigns for building up the awareness of drivers about the needs and requests of non-motorized traffic participants.

Based on the research and reports about the accidents involving pedestrians, the working version of pedestrian traffic plan should be presented to municipality members, representatives of economy, ecology groups and citizens in order to reach the decision about the town areas which need immediate action and to make the list of priorities.
Although pedestrian mobility is in focus here, measures for cyclists should also be implemented by securing suitable and safe bicycle lanes.

Securing safe pedestrian and cyclist zones is possible by forming car-free areas in town centers or in streets available only for public transport vehicles. Naturally, it is possible to undertake some of the following measures:

- Shorter waiting period at traffic lights and longer green light for pedestrians;
- Designing pedestrian and cyclist lanes, such as cyclist lanes from home to schools;
- Better control and penalty measures, or better monitoring of traffic violations (eg. speeding, parking on the pavements, etc.);
- Expert training of municipality staff responsible for traffic policy.

Giving priority to the needs and requests of pedestrians is only the first step in the political agenda, but a crucial one. Having in mind that finances can cause problems, the measures for increasing security should be combined with:

- The construction of new streets and reconstruction of the old ones;
- The decrease in the volume of traffic in the whole town and improving traffic handling in areas relying on the town center;
- The measures rehabilitating urban areas, such as redesigning town squares and making streets into residential areas.

6.4 Sustainable urban transport - reduction in the use of energy, air pollution and level of noise

Only the combination of parking handling, improvement of public transport and increase of security of non-motorized traffic participants, can lead to sustainable mobility in towns. What should be added to all this are measures for the reduction of energy use, air pollution and level of noise:

- By using contemporary technologies in handling and managing traffic, towns could reach up to 30% of energy saving;
- Improving and ren ewing traffic infrastructure;
- Modernize car pools and introduce contemporary vehicles which would influence energy savings up to 30%;
- Stimulate population to use public transport;
- Find new ways of ensuring financing of traffic in towns, by a significant raise in funds from the budget (i.e. provide suburban municipalities with larger funds). These financial means must, in the first place, be aimed at improving public transport and traffic handling system;
- Change certain regulations and urban practice, allow faster construction and building of parking spaces, garages, etc;
- Free the vehicle import from high customs rates and taxes, and aggravate the restrictive policy of the insurance of old vehicles;
- Aiming at the reduction of ecological risks, it is necessary to support by law the organized process of recycling waste materials and unusable cars, which is a common thing now in the European Union.

6.5 Necessary institutions, policies, motives, instruments and measures

Institutions

To ensure the development of traffic, the following institutions will be needed, which do not exist now (*Strategy of economy development in Serbia up to 2010*):

1. **At the state level**
   - The agency for implementation of the adopted strategies of traffic development, which would coordinate the activities of state institutions and transport corporations of all types, would ensure the legal and fiscal support;
   - Transport services market;
   - Quality center;
   - Laboratory for measuring devices in vehicles, fuel of a good quality, good condition of traffic arteries, etc.) which would finance itself;
   - Agency for managing maintenance of traffic arteries and equipment;
   - Advice for traffic security;
   - Agency for developing IT –technologies in the traffic area.

2. **In towns (depending on the territory)**
   - Traffic ministry (they exist only in Belgrade and Novi Sad);
   - Board for handling public transport (exists only in Belgrade);
   - Board for handling traffic in towns;
   - Parking corporations (exist only in Belgrade);
   - Informational centers for traffic participants;
   - Centre – data base of traffic information in local self-governments;

Policies

- Harmonize law regulations for the EU, because otherwise Serbia would drastically diminish its likelihood to communicate with other countries;
- Stimulating policy of renewing infrastructure and transport means, which would lead to more energy efficient, more secure and ecological-friendly transport;
- The policy of transport costs; tax policy should disencourage the acquirement and use of technologically old transport means;
- Stimulating policy of introducing private transport corporations;
- Ensure larger financial means through the budget for local self-governments;
- Use the income from retail prices of fuel and road taxes for improving traffic arteries and public transport, not only infrastructure, as it was the case up to now;
- Use the incomes from traffic violation fines for improving security in traffic.

Motives, instruments and measures

- There is a growing number of traffic accidents in Serbia, whereas in the EU the situation is the opposite in the last few years;
- Monitoring transport policy in the EU which is characterized by a correlation of different networks (interconnectibility), correlation of different modalities (intermodality) and correlation of different services (interoperability);
- Stimulate renewal and destimulate the use of out-of-date transport means which are unsafe, energetically inefficient and ecologically unsuitable;
- Law regulation for towns to design and implement *Master Transport Plan* and innovate it every 7 years;
- Protection of the environment.

7. INSTEAD OF CONCLUSION

Serbia is, as well as other countries in the Central and Eastern Europe, in the process of transition from the centralized into the market economy.

It is clear that when determining transport policy priorities, economy, social, cultural and other differences among the countries in this region should be taken into consideration. Generally speaking, Serbia has not gone far in this process of transition, compared to other coumtry members of the EU. Law regulations are still different from those in the EU, although it is clear that the future period will bring the process of harmonizing laws and regulations in the domain of traffic and transport. Because of the poor quality of traffic infrastructure, bad maintaining and acute traffic problems, the influence/effect that traffic has on environment is not of a higher priority at the moment.

It is not easy to find the appropriate ballance between the aims of sustainable development, on one hand, and economy and social aims, on the other hand. These aims are in a conflict, which becomes evident in the example of the EU, where it is very difficult to decrease the emission of CO_2, even alongside the well defined policies. In the countries which prioritize ecological issues, the aims of preserving and improving environment are in the background, at least at the early stages of development.

However, the government, as well as town authorities, should aim at formulating the national transport polisy and sustainable development policy in towns.

8.1

S U R V E Y
– ATTITUDES TOWARDS THE MODES OF TRANSPORT –

Basic Report

Realized by
SMMRI

February 2003

CONTENTS

Introduction

During the work on the ***New urban transportation politics in Serbia as agents of sustainable development*** project, the following towns have been chosen for the further survey:

- Subotica
- Novi Sad
- Belgrade
- Kragujevac
- Niš

When making the selection of towns, the whole geographical territory of Serbia has been taken into account, as well as towns of different territories and population, that are typical for Serbia.

According to the territory, the towns in this survey can be divided into three categories:

- metropolises, with a population of more than 1,000,000 inhabitants: Belgrade (1,602,226 inhabitants)
- large towns, with a population between 200,000 and 300,000: Novi Sad (265,464 inhabitants) and Nis (247,755 inhabitants)
- middle-sized towns, with a population of 100,000 and 200,000: Subotica (150,534 inhabitants) and Kragujevac (180,084 inhabitants)

This survey has been conducted in these towns. The aim of the survey was twofold. On one hand, we got the data about the everyday commuting, and on the other hand we found out the opinions of citizens about the traffic problems in towns.

The results of the survey are presented in tables. The tables show the results for Serbia as a whole and for the towns separately.

Methodology

- ✓ 5 towns have been chosen from the original sample: Belgrade, Nov Sad, Niš, Subotica, Kragujevac
  - o Original sample includes 1762 examinees older than 15
- ✓ sample in three stages
  - o First stage: community centers chosen at random (as a part of region)
  - o Second stage: households have been chosen by the "random step" method
  - o Third stage: an examinee in a household has been chosen by Kis's tables
- ✓ IN household, face-to-face interviewing
- ✓ Terrain work: 17th – 23rd February

Types and number of vehicles owned by a household?

Serbia	Col Response %
Car	54.3
Bicycle for adults	30.6
Motorcycle	3.4
Freight vehicles	0.9
None	33.8

	Sex		Age groups					Education		
	Male	Female	15 – 29	30 – 39	40 – 49	50 – 59	+ 60	Primary	Secondary	Higher
Car	57.0	51.8	55.4	74.8	53.1	49.8	41.3	33.1	53.9	60.4
Bicycle for adults	34.9	26.6	43.2	35.2	37.5	18.4	16.6	37.1	32.9	24.4
Motorcycle	3.8	2.9	5.3	6.2	4.1	1.3		4.4	3.8	2.3
Freight vehicles	0.8	1.1	1.4	1.3	1.1		0.9	2.1	1.0	0.5
None	29.1	38.2	25.9	12.0	27.1	46.2	56.0	44.6	33.8	31.2

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	More than 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Car	54.8	60.2	49.5	63.6	49.0	78.7	72.2	48.1	73.3	68.1
Bicycle for adults	40.2	25.1	26.9	43.1	23.4	88.3	46.1	20.9	29.2	73.2
Motorcycle	2.3	3.4	2.7	5.7	2.0	4.9	6.0	2.7		8.5
Freight vehicles			1.3	0.5	1.2			1.3		
None	30.1	32.9	39.6	20.8	41.2	11.7	18.1	40.9	17.6	5.6

How many vehicles have you got in the household?

Bicycle for adults

	Percentage
1	20.9
2	6.7
3	1.4
4	0.8
5	0.2
No answer	0.5
No bicycle	69.4
Total	100.0

Motorcycle

	Percentage
1	3.0
2	0.2
No answer	0.2
No motorcycle	96.6
Total	100.0

Cars

	Percentage
1	47.1
2	5.3
3	1.0
No answer	0.9
No car	45.7
Total	100.0

Freight vehicle

	Percentage
1	0.9
No freight vehicle	99.1
Total	100.0

What is the distance to work/faculty/school …

Serbia	Percentage
Don't commut e	32.1
More than 5 km	30.8
Between 3-5 km	12.6
Between 1-3 km	11.4
Less than 1 km	9.7
No answer	3.5
Total	100.0

	Sex		Age groups					Education		
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	60 +	Primary	Secondary	Higher/University
Less than 1 km	9.9	9.4	11.9	10.0	14.4	10.7		12.8	9.8	8.7
Between 1-3 km	14.5	8.5	17.0	8.5	19.8	8.4	0.9	8.3	12.9	9.2
Between 3-5 km	12.0	13.2	19.4	14.3	12.2	13.9			13.6	13.9
More than 5 km	34.8	27.1	42.3	48.5	29.5	30.3		16.1	32.2	31.8
Don't commute	24.2	39.2	9.4	13.5	20.0	29.5	97.2	52.2	27.9	35.0
No answer	4.6	2.6		5.2	4.1	7.2	1.8	10.6	3.7	1.3
Tota	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	More than 9000 din	Yes	No	Subotica	Novi Sad	Beograd	Kragujevac	Niš
Less than 1 km	7.4	9.6	11.0	12.4	8.1	5.7	10.5	8.8	13.7	17.6
Between 1-3 km	13.7	10.2	11.2	11.9	11.1	29.5	18.8	7.6	32.3	15.8
Between 3-5 km	8.6	15.8	14.4	12.1	12.9	27.9	14.2	11.5	10.4	13.6
More than 5 km	27.5	30.8	34.8	31.9	30.1	26.9	29.2	35.3		9.2
Don't commute	38.1	33.1	27.1	25.7	35.7	10.1	27.4	32.3	43.6	41.5
No answer	4.6	0.6	1.6	5.9	2.2			4.5		2.4
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

The way you USUALLY get to work/faculty/school (everyday commuting)

Serbia	Percentage
By public transport (buses, trolleybuses, trams)	34.6
By car	15.1
On foot	13.6
By bicycle	0.8
Other	1.5
No answer	2.4
Doesn't commute	32.1
Total	100.0

	Sex		Age groups					Education		
	Male	Female	15-29	Male	Female	15-29	Male	Female	15-29	Male
By public transport (buses, trolleybuses, trams)	32.4	36.6	52.5	40.8	35.3	36.4		20.9	40.0	27.8
By car	23.5	7.5	14.8	31.2	23.4	9.3		4.4	14.0	20.0
On foot	14.4	12.9	20.3	13.1	16.6	13.1	1.8	17.1	14.5	10.8
By bicycle	1.2	.5		1.4	1.4	1.5			.8	1.0
Other	1.8	1.2			2.1	4.9			0.7	3.4
No answer	2.7	2.1	3.0		1.1	5.4	0.9	5.4	2.2	1.9
Doesn't commute	24.2	39.2	9.4	13.5	20.0	29.5	97.2	52.2	27.9	35.0
Tota	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
By public transport (buses, trolleybuses, trams)	35.1	33.6	38.5	30.5	36.9	17.4	36.0	39.5	3.2	14.6
By car	8.9	19.0	14.9	20.9	11.8	42.0	24.9	12.8	13.7	10.9
On foot	13.3	12.7	15.8	15.3	12.6	20.3	8.0	10.9	39.6	26.5
By bicycle		1.0	0.8		1.3	10.3	3.7			
Other	2.2		3.0	3.4	0.4			2.0		
No answer	2.4	0.7		4.2	1.3			2.5		6.5
Doesn't commute	38.1	33.1	27.1	25.7	35.7	10.1	27.4	32.3	43.6	41.5
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

If you were using a car, under which conditions would you change this means of transport?

Serbia	Col Response %
Under no conditions	42.1
Better organisation of public transport routes	36.4
More regular public transport	27.6
Vicinity of working place/school/faculty	22.7
Existence of bicycle infrastructure	1.5
Other	8.5

	Sex		Age groups				Education	
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	Primary and Secondary	Higher
Under no conditions	42.0	42.3	63.9	31.4	42.2	29.5	47.0	35.6
Better organisation of public transport routes	37.2	34.3	9.8	53.4	33.1	49.3	38.9	33.0
More regular public transport	28.9	24.3	10.5	32.5	33.1	35.2	34.3	18.7
Vicinity of working place/school/faculty	24.5	18.1	20.3	25.3	24.8	17.7	15.9	31.9
Existence of bicycle infrastructure	2.0		6.0				2.6	
Other	11.6		5.4	6.6	8.3	17.7	2.3	16.7

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Under no conditions	60.6	34.4	32.3	38.8	45.3	38.3	60.5	34.9	100.0	43.4
Better organisation of public transport routes	39.4	41.8	40.9	38.3	34.6	39.0	19.4	43.3		21.7
More regular public transport	22.0	35.4	31.1	29.4	25.9	50.4		30.4		35.0
Vicinity of working place/school/faculty		39.5	19.8	26.1	19.5		20.1	29.5		21.7
Existence of bicycle infrastructure		4.5			2.9	11.6				
Other		12.2	14.6	4.6	12.2			13.3		

If you are using public transport, what, in your opinion, should be done to improve it?

Serbia	Col Response %
Improve frequency	73.5
Better, new vehicles	61.7
Improve punctuality	55.9
Improve comfort	38.9
Cheaper tickets	33.8
Introduce monthly tickets	28.5
Something else	1.2
No answer	3.0

	Sex		Age groups				Education	
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	Primary and secondary	Higher
Improve frequency	69.8	75.8	77.2	73.8	73.3	65.9	72.8	74.3
Better, new vehicles	65.7	58.0	62.3	72.0	49.0	61.5	60.3	64.8
Improve punctuality	55.3	55.9	50.4	69.2	46.6	60.6	56.1	54.3
Improve comfort	40.3	37.4	43.6	34.4	29.0	41.8	42.5	27.4
Cheaper tickets	35.3	32.4	44.5	16.5	29.2	33.0	41.9	9.2
Introduce monthly tickets	24.1	31.8	31.1	30.8	20.8	28.0	28.0	29.3
Something else	2.7					5.1	1.6	
No answer	4.2	2.9	4.2	3.3	6.7		4.7	

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Improve frequency	80.0	67.1	72.6	78.1	70.8	100.0	51.9	74.7	100.0	69.0
Better, new vehicles	58.8	67.1	62.0	64.5	60.0	67.4	33.1	65.1		49.2
Improve punctuality	47.3	49.2	62.0	45.7	60.3	26.8	14.0	60.9	100.0	50.2
Improve comfort	42.0	35.1	37.6	41.2	37.6		42.0	38.7	100.0	50.2
Cheaper tickets	30.7	25.6	29.3	32.9	34.0		14.4	34.4		100.0
Introduce monthly tickets	37.1	31.9	15.5	34.9	25.3		7.2	30.8	100.0	37.0
Something else			3.7		1.8			1.4		
No answer	2.2	6.6	1.5		5.1		27.3	1.1		

Do you think that the increased number of cars in towns is a problem?

Serbia	Percentage
Yes	75.5
No	16.3
Don't know	8.1
Total	100.0

	Sex		Age groups					Education		
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	60 +	Primary	Secondary	Higher
Yes	74.0	76.9	60.7	76.9	81.1	83.4	80.0	67.6	72.4	83.7
No	19.7	13.3	29.2	13.8	16.8	8.4	9.4	15.6	18.6	12.0
Don't know	6.3	9.8	10.1	9.3	2.1	8.1	10.6	16.8	9.0	4.3
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Yes	77.4	75.7	73.2	73.8	76.5	72.7	80.7	77.6	75.6	50.5
No	12.9	18.0	19.5	19.3	14.6	16.8	9.9	15.1	21.1	32.4
Don't know	9.7	6.3	7.3	6.9	8.9	10.5	9.4	7.2	3.3	17.1
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

If you think there are too many cars in towns, who, do you think can solve this problem?

Serbia	Col Response %
City/Town	74.7
Country	16.4
We, ourselves	14.5
Don't know	3.3

	Sex		Age groups					Education		
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	60 +	Primary	Secondary	Higher
City/Town	75.0	74.5	77.5	80.7	79.5	74.8	61.2	70.7	74.6	75.7
Country	18.1	14.9	14.1	12.3	7.7	21.8	24.1	19.5	15.9	16.5
We, ourselves	12.3	16.4	13.4	13.1	12.7	13.0	20.8	22.9	16.2	10.0
Don't know	4.3	2.4	5.6	1.7	1.3	4.9	2.2	5.4	3.0	3.4

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
City/Town	72.7	77.0	73.6	72.7	75.8	84.4	67.7	74.1	73.2	89.1
Country	16.2	13.4	20.4	12.8	18.3	7.8	12.8	17.7	13.8	13.0
We, ourselves	16.6	16.3	14.1	15.2	14.1	7.8	13.0	16.3	4.6	5.5
Don't know	4.4	1.7	4.0	3.4	3.3		11.3	2.4	8.5	

In your opinion, which policy should be used in towns to improve the traffic?

Serbia	Col Response %
Increasing parking capacity	59.6
Improving public transport (frequency, punctuality, quality)	59.1
Limited access to the centre for cars	30.4
Giving priority to pedestrians and bicyclists	28.3
Subsidised public transport	13.2
High price of parking tickets in the centre	12.3
Other	5.8
No answer	1.2

	Sex		Age groups					Education		
	Male	Female	15 -29	30 - 39	40 - 49	50 - 59	60 +	Primary	Secondary	Higher
Increasing parking capacity	59.2	59.9	68.7	66.7	54.0	53.1	54.1	51.3	63.3	54.5
Improving public transport (frequency, punctuality, quality)	59.0	59.2	55.9	54.4	63.3	60.0	62.6	57.2	58.2	61.4
Limited access to the centre for cars	28.9	31.8	20.7	39.4	24.0	41.1	29.0	33.3	26.9	36.4
Giving priority to pedestrians and bicyclists	26.5	29.9	26.5	29.9	35.6	24.9	26.3	26.8	29.4	26.5
Subsidised public transport	14.3	12.2	8.1	10.7	13.2	20.7	13.1	6.2	14.3	12.8
High price of parking tickets in the centre	10.5	14.0	10.0	12.9	11.9	15.2	11.9	12.6	13.7	9.6
Other	8.6	3.1	5.4	10.0	3.0	4.9	6.4	2.1	4.4	9.4
No answer	2.1	0.3			1.9	1.8	2.2	4.4	1.1	0.6

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Increasing parking capacity	62.2	65.3	54.5	60.9	58.9	67.2	66.1	56.6	96.8	54.3
Improving public transport (frequency, punctuality, quality)	62.0	60.8	57.2	55.1	61.4	58.0	22.4	64.7	71.2	40.2
Limited access to the centre for cars	31.4	38.9	32.9	29.5	30.9		53.2	29.9	23.9	31.0
Giving priority to pedestrians and bicyclists	30.6	28.4	28.8	28.7	28.1	34.8	44.2	25.4	38.7	27.8
Subsidised public transport	15.4	11.8	10.5	11.5	14.1	23.3	10.2	12.1	20.0	16.8
High price of parking tickets in the centre	9.9	13.7	14.1	10.3	13.5	5.6	24.2	12.8		5.4
Other	3.6	2.1	8.6	7.1	5.0	4.7		7.2		2.4
No answer	0.6		2.2	1.4	1.0		2.0	1.0		3.0

Would you like to participate actively in the independent organization of citizens, which would take care of traffic problems?

Serbia	Percentage
Yes	21.7
No	78.3
Total	100.0

	Sex		Age groups					Education		
	Male	Female	15 - 29	30 - 39	40 - 49	50 - 59	60 +	Primary	Secondary	Higher
Yes	22.6	21.0	16.6	14.9	25.2	31.5	19.1	8.0	22.7	23.3
No	77.4	79.0	83.4	85.1	74.8	68.5	80.9	92.0	77.3	76.7
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	Income per household member?			Children over 18 in the household?		City/Town				
	Up to 5400 din	From 5400 to 9000 din	Over 9000 din	Yes	No	Subotica	Novi Sad	Belgrade	Kragujevac	Niš
Yes	24.3	24.9	22.8	19.3	23.1	32.2	22.5	20.8	26.5	20.8
No	75.7	75.1	77.2	80.7	76.9	67.8	77.5	79.2	73.5	79.2
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Demography (Serbia -total)

Sex

	Percentage
Male	47.7
Female	52.3
Total	100.0

Age groups

	Percentage
15 - 29	25.6
30 - 39	15.9
40 - 49	18.2
50 - 59	22.7
60 +	17.6
Total	100.0

Education

	Percentage
Primary	8.0
Secondary	60.5
Higher	31.5
Total	100.0

Income per household member?

	Percentage
Up to 5400 din	27.7
From 5400 to 9000 din	26.8
Over 9000 din	29.4
Refuses to say	16.1
Total	100.0

Children over 18 in the household?

	Percentage
Yes	36.3
No	63.7
Total	100.0

REVIEW OF THE CRUCIAL RESULTS OF THIS SURVEY

- ✓ From all the households in Serbia participating in the survey, 54.3% owns a car, whereas 30.6% owns a bicycle. An interesting data is that the number of households in Belgrade owning a car is below the republic average (48.1%), and even much lower than in other analyzed towns (Subotica - 78.7%, Novi Sad-72.2%, Kragujevac-73.3%, Niš-68.1%).
  The number of bicycles in a household is the lowest in Belgrade, which was anticipated, because of the large territory of the city and its relief. The largest number of bicycles is found in Subotica, which is a town in the plain with long tradition in using bicycles for everyday needs.

- ✓ According to the sample for the whole territory of Serbia, a large number of examinees who travel to their working place/school/faculty, crosses the distance of more than 5 km (30.8%), 12.6% of them crosses the distance between 3 and 5 km, whereas only 9.7% of the examinees travel for less than 1 km. If we take towns in account, then this distance is different from town to town, depending on the territory of the town. In Belgrade, majority of examinees (35.3%) covers a distance of more than 5 km. In Subotica this percentage (26.9%) is quite high considering that this is the town with the smallest population of all towns surveyed. But we should also have in mind that Subotica has large territory, even 1007 km^2, and that the population density is small, 149 inhabitants/km^2. In Niš, the majority of everyday travels cover the distance of less than 1 km (17.6%).

- ✓ At the territory of the whole Serbia, the majority of population travels to their working place/school/faculty by public transport (34.6%), the second place is taken by the car, with 15.1%, walking takes 13.6%, whereas the percentage of those who travel by bicycle is irrelevantly small. In Belgrade, the majority of commuting is done by public transport (39.5%), while a car is used by only 12.8% of examinees. It is interesting that in Subotica people use cars the most for everyday travels, even 42% of them, then there is walking with 20.3%. In Kragujevac and Niš, walking to a working place/school/faculty is a predominant mode of transport (39.6% and 26.5% respectively).

- ✓ When asking the examinees under which conditions they would change this means of transport if they are using a car, the prevailing answer for the whole territory of Serbia is that examinees would not agree to that under any conditions (42.1%), while 36.4% examinees would shift to using public transport if it would be better organized. Looking at towns separately, the majority of people would not shift to public transport under any conditions, except in Belgrade where 43.3% of examinees would shift to using public transport if it would be better organized.

- ✓ The main objections to public transport are frequency, quality of the vehicles, punctuality and comfort. The results are similar for the whole Serbia as well as for towns separately.

- ✓ The majority of examinees thinks that increasing number of cars in towns is alarming (75.5% of them). Also, the majority of examinees think that this is the problem for city authorities to solve (74.7% of them).

- ✓ From all the policies that should be applied in towns in order to improve traffic, examinees mention: improving parking capacity, improving the quality, frequency and punctuality of public transport, close access to the centre of towns for cars and giving priority to pedestrians and bicyclists.

- ✓ Great disinterestedness of examinees to participate actively in the independent organization of citizens which would take care of traffic problems, is quite evident – on the average, even 78.3% examinees in Serbia are not interested in this kind of activity.

8.2 AIR POLLUTION AT THE TERRITORY OF SERBIA BETWEEN 1991 AND 2000

Rapid industrialization and movement of the population from rural areas to towns and cities caused the creation of unnatural concentration of pollutants in those areas. The need for energy, industry, traffics and other things have come down to a small territory as well as the objects, which provide the fulfilment of such.

The pollution does not stay isolated only in one medium (water, air, soil) and at the same territory, but it spreads beyond national and continental borders.

The most significant air pollution sources in towns are industrial installations, but energy installations (heating plants, energy plants and household fuel-chambers) and the traffic cannot be ignored. Which polluting substances are going to pollute the air and what will the level of its concentration be, first of all depends on the type, the number and the capacity of polluting sources.

Apart from the polluting source, meteorological conditions, city planning, configuration of the terrain, etc indirectly influence the degree of air pollution.

According to the definition of World Health Organization (WHO), the air is polluted when it contains certain substances in the amount, which is harmful in the first place to humans, and then to his surrounding (plants, animals, material and cultural goods).

Most commonly present and studied polluting substances in the air are: sulphur dioxide, soot, sedimentary substances, carbon monoxide, nitrogen oxides, ammonia, chlorine hydrogen, fluorhydrocarbon, hydrogen sulphide, floating particles, photochemical oxidants and ozone, organic substances (formaldehyde, carbon disulphide, styrene, tetrachloroethylene, toluene, acrolein) and toxic metals (lead, cadmium, manganese, mercury, etc.).

Air pollution in Serbia is monitored by the Health Care Institution of Serbia "Dr. Milan Jovanovic Batut", and the Centre of Environmental Protection and Promotion.

POLLUTING SUBSTANCES ORIGINATING FROM EXHAUST GASES FROM MOTOR VEHICLES

About the condition of the air polluted by polluting substances originating from motor vehicles exhaust gases during 2000, we have data only for Belgrade. Polluting substances that have been monitored are: carbon monoxide, nitrogen dioxide, and formaldehyde lead and total hydrocarbons (table 11).

An average annual amount of carbon monoxide emission was 8.324 mgr/m^3. An average annual amount of emission exceeded the average annual limit of emission amount approved for inhabited areas, which was 3.0 mgr/m^3.

An average annual amount of nitrogen dioxide emission was 0.128 mgr/m^3. An average annual amount of emission exceeded the average annual limit of emission amount approved for inhabited areas, which was 0.060 mgr/m^3.

An average annual amount of formaldehyde emission was 0.024 mgr/m^3. An average annual amount of emission did not exceed the average annual limit of emission amount approved for inhabited areas, which was 0.100 mgr/m^3.

An average annual amount of lead emission was 1.2 mgr/m^3. An average annual amount of emission exceeded the average annual limit of emission amount approved for inhabited areas, which was 1.0 microgr/m^3.

An average annual amount of hydrocarbon emission was 0.035 mgr/m^3. An average annual amount of emission exceeded the average annual limit of emission amount approved for inhabited areas, which was 3,0 mgr/m^3.

Pollution of air by polluting substances originating from motor vehicles exhaust gases in Belgrade and other towns shows a trend of increase.

SUGGESTED MEASURES

Systematic control of air pollution is conducted in a very unpretentious perimeter, in a small number of settlements, and in very few measurement locations by monitoring limited and increasingly smaller number of polluting substances. This state is the outcome of the social and economy conditions that we are in.

Considering that the industry used to function with diminished capacity in the recent period, and that the social and economy conditions will progress as well as industrial capacities will be recovered, our assessment is that in the future period will bring rapid increase in air pollution. This air pollution will appear as the result of out-of-date technologies and problems in connection with getting accustomed to how technological processes function.

It is necessary to accelerate engagement on issuing sub-juridical regulations in the field of emitting polluting substances into air and to form a registry of air pollutants at the territory of the republic of Serbia.

It is essential that municipalities make their own Programmes for controlling the quality of air after the fashion of the Programme of controlling the quality of air in the Republic of Serbia (Gazette, No 9/96). This should especially be so for the municipalities which did not closely define the problems of preserving environment in connection to preserving air, especially if, in their territory, they have locations of larger sources which contaminate air.

Table 1:

An average annual amount of the concentration of sulphur dioxide (SO_2) in a system of health services at the territory of the Republic of Serbia between 1991 and 2000 (mg/m^3)

Ord. No.	Settlement	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	Belgrade	74.0	35.0	16.0	12.0	12.0	15.4	19.0	18.0	14.0	10.0
2.	Kragujevac	78.1	58.6	83.3	109.2	81.0	63.6	63.3	85.0	70.3	48.5
3.	Niš	47.8	37.2	70.0	85.4	43.7	31.7	47.0	14.4	13.0	-
4.	Novi Sad	30.7	-	18.3	-	19.0	25.0	15.0	9.0	33.0	-
5.	Subotica	-	-	-	-	-	4.7	8.3	6.9	2.4	2.3

$GVI_{x\ years}SO_2 = 50.0\ \mu gr/m^3$

Table 1a:

Number of days with the amounts of sulphor dioxide through the GVI in a system of health services at the territory of the Republic of Serbia between 1991 and 2000 (%)

Ord. No.	Settlement	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	**Belgrade**	11.3	1.7	0.1	0.1	0.0	0.2	0.0	0.2	0.04	0.0
2.	**Kragujevac**	15.9	5.7	15.4	24.6	15.2	8.0	9.7	9.0	6.3	0.4
3.	**Niš**	3.7	3.0	12.6	9.6	2.6	0.7	4.4	0.1	0.0	-
4.	**Novi Sad**	1.7	-	0.9	-	0.4	2.5	1.0	0.0	2.4	-
5.	**Subotica**	-	0.1	-	-	-	0.0	01	0.0	0.0	0.0

$GVI_{x\ years}SO_2 = 150\ \mu g/m^3$

Table 2 :

An average annual amount of the concentration of soot in a system of health services at the territory of the Republic of Serbia between 1991 and 2000 (mg/m^3)

Ord. No.	Settlement	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	**Belgrade**	39.0	33.0	28.0	23.0	23.0	25.7	29.0	31.0	27.0	28.0
2.	**Kragujevac**	12.2	12.4	8.7	10.6	16.3	19.5	17.3	12.7	13.7	-
3.	**Niš**	15.2	12.1	6.9	8.4	9.1	5.0	7.0	7.2	18.0	-
4.	**Novi Sad**	25.8	-	12.9	-	9.0	9.0	8.0	7.0	6.0	-
5.	**Subotica**	-	0.0	-	-	-	5.5	7.4	9.8	7.9	6.3

$GVI_{x\ years}soot = 50.0\ \mu g/m^3$

Table 2a :

Number of days with the amounts of soot through the GVI in a system of health services at the territory of the Republic of Serbia between 1991 and 2000 (%)

Ord. No.	Settlement	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	Belgrade	24.6	15.2	14.1	8.0	8.0	9.3	0.2	14.7	11.8	0.9
2.	Kragujevac	1.7	1.7	0.9	1.1	1.4	3.4	1.4	2.8	1.1	0.2
3.	Niš	4.7	7.1	1.8	2.9	2.2	0.7	1.8	2.3	8.2	-
4.	Novi Sad	11.6	-	3.9	-	0.8	0.9	0.5	0.2	0.15	-
5.	Subotica	-	0.0	-	-	-	0.0	0.6	0.6	0.2	0.1

Table 3 :

An average annual amount of the concentration of sedimentary substances in a system of health services at the territory of the Republic of Serbia between 1991 and 2000 (mg/m^3)

Ord. No.	Settlement	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	Belgrade	365.6	541.9	401.9	332.4	414.0	307.9	230.2	254.9	323.1	219.5
2.	Kragujevc	536.8	582.2	-	338.1	611.1	467.8	334.2	300.4	240.9	254.0
3.	Niš	294.8	276.2	360.6	370.6	367.4	294.0	293.0	269.5	400.0	-
4.	Novi Sad	223.4	-	199.1	-	142.8	158.8	191.1	181.7	124.9	-
5.	Subotica	-	-	-	-	-	275.3	145.0	197.0	213.0	126.0

$GVI_{x\ years}$ = 200. 0 mg/m^2/day

Table 4 :

The perimeter of monitoring polluting substances in a system of health services in settlements at the territory of the Republic of Serbia between 1991 and 2000 (number of measurement locations)

Ord. No.	Settlement (measurement locations number)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	Belgrade	-	-	-	-	8	8	14	15	15	20
2.	Niš	-	-	-	-	6	4	6	6	6	-
3.	Novi Sad	-	-	20	-	12	12	20	18	18	-
4.	Subotica	-	6	-	-	-	6	6	7	7	7

Table 5:

An average annual amount of inorganic polluting substances originating from industry in a system of health services at the territory of the Republic of Serbia between 1992 and 2000 (mg/m^3)

Polluting substances	Settlement	1992	1993	1994	1995	1996	1997	1998	1999	2000
Ammonia	Belgrade Niš	- -	- -	49.7 -	64.3 200.0	151.4 0.7	- 2.6	225.6 -	138.3 14.9	160.0 -
Chlorine hydrogen	Belgrade	-	-	23.0	31.0	31.0	-	54.3	37.5	34.8
Fluorine hydrogen	Subotica	1.1	-	-	-	-	-	-	-	-
Nitrogen dioxide	Belgrade Niš Novi Sad Subotica	- - - -	- - - -	38.0 - - -	34.7 - - -	55.4 29.8 - 11.5	21.0 32.2 - 9.9	37.0 - - 10.4	34.6 - 12.0 9.9	28.7 - - 10.5
Sulphur hydrogen	Niš	-	-	-	1.0	0.1	2.1	-	2.1	-
Suspended particlestice	Belgrade	-	-	532.0	144.4	94.4	106.9	-	519.9	-
Ground ozone	Novi Sad	-	-	-	-	-	11.0	-	-	-

Ammonia GVI $_{x\ years}$ = 200.0 μg/m^3
Nitrogen dioxide GVI $_{x\ years}$ = 60.0 μg/m^3
Hydrogen sulfide GVI $_{x\ years}$ = 8.0 μg/m^3
Mercury GVI $_{x\ years}$ = 1.0 μg/m^3
Suspended particles GVI $_{x\ years}$ = 70.0 μg/m^3
Carbon monoxide GVI $_{x\ years}$ = 10.0 mg/m^3
Fluorhydrocarbon GVI $_{x\ years}$ = 20.0 μg/m^3
Chlorine hydrogen GVI $_{x\ years}$ = 50.0 μg/m^3
Chlorine GVI $_{x\ years}$ = 100.0 μg/m^3

Table 6:

An average annual amount of organic polluting substances originating from industry in a system of health services at the territory of the Republic of Serbia between 1992 and 2000 (mg/m^3)

Polluting substances	Settlement	1992	1993	1994	1995	1996	1997	1998	1999	2000
Acrolein	Belgrade	-	-	18.0	43.0	16.0	-	2.4	<1.0	<1.0
Benzo (a) pyrene ng/ m^3	Belgrade	-	-	-	-	0.2	-	0.7	0.43	0.4
Total hydrocarbons	Belgrade	-	-	135.0	64.0	109.0	-	-	-	-
Phenol substances	Belgrade	-	-	20.0	15.0	22.0	-	20.3	20.0	11.9
Formaldehyde	Belgrade Subotica	- -	- -	16.0 -	8.0 -	11.0 1.0	- -	13.8 -	2.1 -	3.6 -

Acrolein GVI $_{x\ years}$ = 100.0 μg/m^3
Benzene GVI $_{x\ years}$ = 800.0 μg/m^3
Vinilchloride GVI $_{x\ years}$ = 50.0 ng/m^3
Dichlorethane GVI $_{x\ years}$ = 500.0 μg/m^3
Toluene GVI $_{x\ years}$ = 500.0 μg/m^3
Carbon disulfide GVI $_{x\ years}$ = 100.0 μg/m^3
Formaldehyde GVI $_{x\ years}$ = 100.0 μg/m^3

Table 7:

An average annual amount of heavy metals in sedimentary substances in a system of health services at the territory of the Republic of Serbia between 1992 and 2000 (mg/m^3)

Heavy metals	Settlement	1992	1993	1994	1995	1996	1997	1998	1999	2000
Arsenic	Subotica	-	-	-	-	-	-	0.03	0.86	-
Iron	Subotica	-	-	-	-	-	-	43.0	53.5	-
Cadmium	Belgrade Novi Sad Niš Subotica	- - - -	- 6.0 - -	4.0 - - -	5.0 4.0 9.7 -	4.3 3.7 8.6 0.0	4.2 4.1 0.7 0.0	2.9 11.3 7.8 0.0	18.8 2.6 7.7 0.05	42.0 - - 0.0
Manganese	Belgrade	-	-	-	-	36.2	38.2	34.5	45.7	49.4
Nickel	Belgrade Niš Novi Sad	- - -	- - 50.0	- - -	- 40.4 44.4	8.4 27.5 31.7	9.3 19.5 49.0	5.6 39.0 -	8.6 16.9 24.8	7.0 - -
Lead	Belgrade Niš Novi Sad Subotica	- - - -	- - 530.0 -	29.0 - - -	95.0 46.9 46.6 -	31.1 65.8 38.9 0.0	38.2 15.2 49.9 0.0	17.7 73.7 24.2 0.0	18.9 108.3 30.5 0.0	26.0 - - 0.0
Chromium (6^+) total	Belgrade Niš	- -	- -	- -	- 10.0	- 16.3	4.9 5.2	15.4 12.0	3.3 16.6	2.4 -
Zinc	Belgrade Novi Sad Subotica	- - -	- 102.0 -	127.0 - -	256.0 75.0 -	102.0 75.3 -	92.4 119.9 116.2	108.3 175.3 54.0	110.8 47.5 69.0	92.5 - 20.1

Cadmium GVI $_{x\ years}$ = 5.0 μg/m^2/day
Lead GVI $_{x\ years}$ = 250.0 μg/m^2/day
Zinc GVI $_{x\ years}$ = 400.0 μg/m^2/day

Table 8:

An average annual amount of heavy metals in soot in a system of health services at the territory of the Republic of Serbia between 1996 and 2000 (μg/m³)

Polluting substance	Settlement	1996	1997	1998	1999	2000
Cadmium	Belgrade Subotica Niš	2.2 <5.0 -	2.3 - 0.01	0.3 - -	- - 0.0	<2.0 - -
Manganese	Belgrade Subotica Niš	10.5 10.0 -	14.9 - 0.14	18.5 - -	- - 0.3	67.8 - -
Nickel	Belgrade	20.4	12.9	36.7	-	82.0
Lead	Belgrade Subotica Niš	113.8 <10.0 -	224.2 - 0.45	215.1 - -	- - 0.42	668.1 - -
Chromium (6^+)	Belgrade	<0.01	3.5	1.6	-	<0.01
Zinc	Belgrade	755.7	205.3	1606.2	-	-

Table 9:

An average annual amount of heavy metals in suspended particles in a system of health services at the territory of the Republic of Serbia between 1992 and 2000 ($\mu g/m^3$)

Heavy metals	Settlement	1992	1993	1994	1995	1996	1997	1998	1999	2000
Arsenic	Belgrade	-	-	0.020	0.001	0.001	0.0001	-	0.000	
Cadmium	Belgrade	-	-	0.004	0.003	0.002	0.002	-	0.002	
	Niš	-	-	-	0.240	0.110	-	-	0.020	
Manganese	Belgrade	-	-	0.041	0.021	0.006	0.017	-	0.136	
	Niš	-	-	-	-	0.170	-	-	0.050	
Nickel	Belgrade	-	-	0.024	0.007	0.002	0.005	-	0.002	
	Niš	-	-	-	-	0.040	-	-	-	
Lead	Belgrade	-	-	0.213	0.064	0.028	0.048	0.42	0.75	
	Niš	-	-	-	1.700	0.330	-	-	0.23	
Chromium (6^+)	Belgrade	-	-	0.007	0.001	0.003	0.003	-	0.017	
	Niš	-	-	-	-	-	-	-	0.060	
Zinc	Belgrade	-	-	-	-	-	0.167	-	0.311	

Mercury GVI $_{x\ years}$ = 1.0 $\mu g/m^3$
Cadmium GVI $_{x\ years}$ = 0.01 $\mu g/m^3$
Manganese GVI $_{x\ years}$ = 1.0 $\mu g/m^3$
Lead GVI $_{x\ years}$ = 1.0 $\mu g/m^3$

Table 10:

An average annual amount of photochemical smog in a system of health services at the territory of the Republic of Serbia between 1995 and 2000 ($\mu g/m^3$)

Photo-chemical smog	Settlement	1995	1996	1997	1998	1999	2000
Ground ozone	Belgrade	35.0	27.0	31.5	11.7	11.8	18.4
	Niš	7.3	8.2	12.4	-	13.1	-
	Novi Sad	5.0	-	-	-	2.6	-
	Subotica	-	-	10.6	-	16.4	-
Nitrogen dioxide	Belgrade	37.5	38.5	-	-	-	-
	Niš	19.9	24.0	28.3	-	23.9	-
	Novi Sad	3.0	-	-	-	2.3	-
	Subotica	-	-	15.6	-	-	
Formaldehyde	Belgrade	8.5	12.8	22.2	20.6	20.3	28.2
	Niš	0.9	2.8	2.8	-	6.4	-
	Novi Sad	2.0	-	-	-	1.2	-
	Subotica	-	-	9.7	-	4.2	9.1

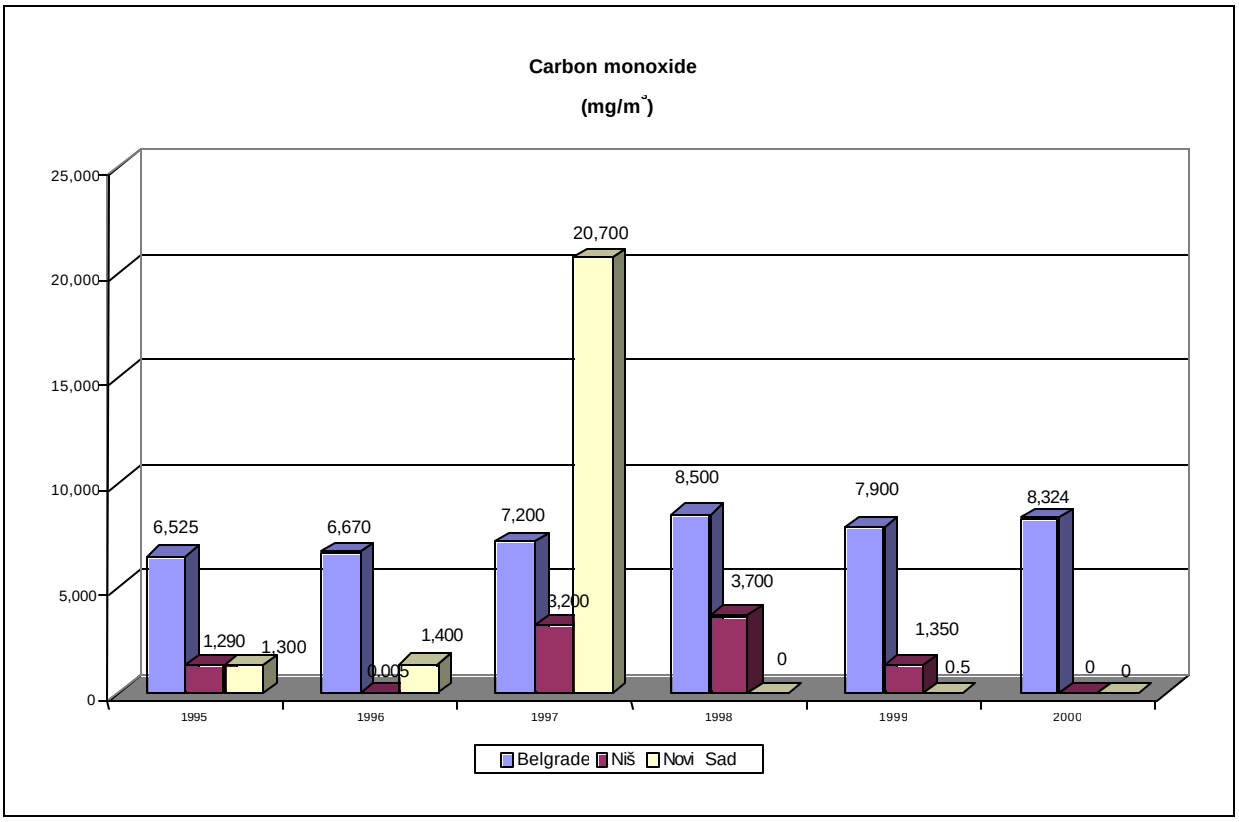
Nitrogen dioxide GVI $_{x\ years}$ = 60.0 $\mu g/m^3$
Ground ozone GVI $_{x\ years}$ = 80.0 $\mu g/m^3$
Formaldehyde GVI $_{x\ years}$ = 100.0 $\mu g/m^3$

Table 11:

An average annual amount of polluting substances originating from motor vehicles in a system of health services at the territory of the Republic of Serbia between 1995 and 2000

Polluting substance	Settlement	1995	1996	1997	1998	1999	2000
Carbon monoxide (mg/m^3)	Belgrade	6.525	6.670	7.200	8.500	7.900	8.324
	Niš	1.290	0.005	3.200	3.700	1.350	-
	Novi Sad	1.300	1.400	20.700	-	0.500	-
Nitrogen dioxide (mg/m^3)	Belgrade	0.112	0.120	0.120	0.130	0.124	0.128
	Niš	0.030	0.025	11.400	0.095	0.098	-
	Novi Sad	0.029	0.025	1.200	-	0.200	-
Formaldehyde (mg/m^3)	Belgrade	0.005	0.004	0.010	0.006	0.011	0.024
	Niš	0.003	0.005	3.900	0.004	0.012	-
	Novi Sad	-	-	-	-	-	-
Lead (mg/m^3)	Belgrade	0.925	1.280	1.320	1.700	2.000	1.2
	Niš	-	-	-	-	-	-
	Novi Sad	0.000	0.030	0.200	-	0.05	-
Total hydrocarbons (mg/m^3)	Belgrade	-	-	-	0.014	0.023	0.035
	Niš	-	-	-	-	-	-
	Novi Sad	-	-	-	-	-	-

Nitrogen dioxide $GVI_{x\ years} = 60.0\ \mu g/m^3$
Lead $GVI_{x\ years} = 1.0\ \mu g/m^3$
Carbon monoxide $GVI_{x\ years} = 3.0\ mg/m^3$
Formaldehyde $GVI_{x\ years} = 0.10\ mg/m^3$


Carbon monoxide
(mg/m3)
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10,000
5,000
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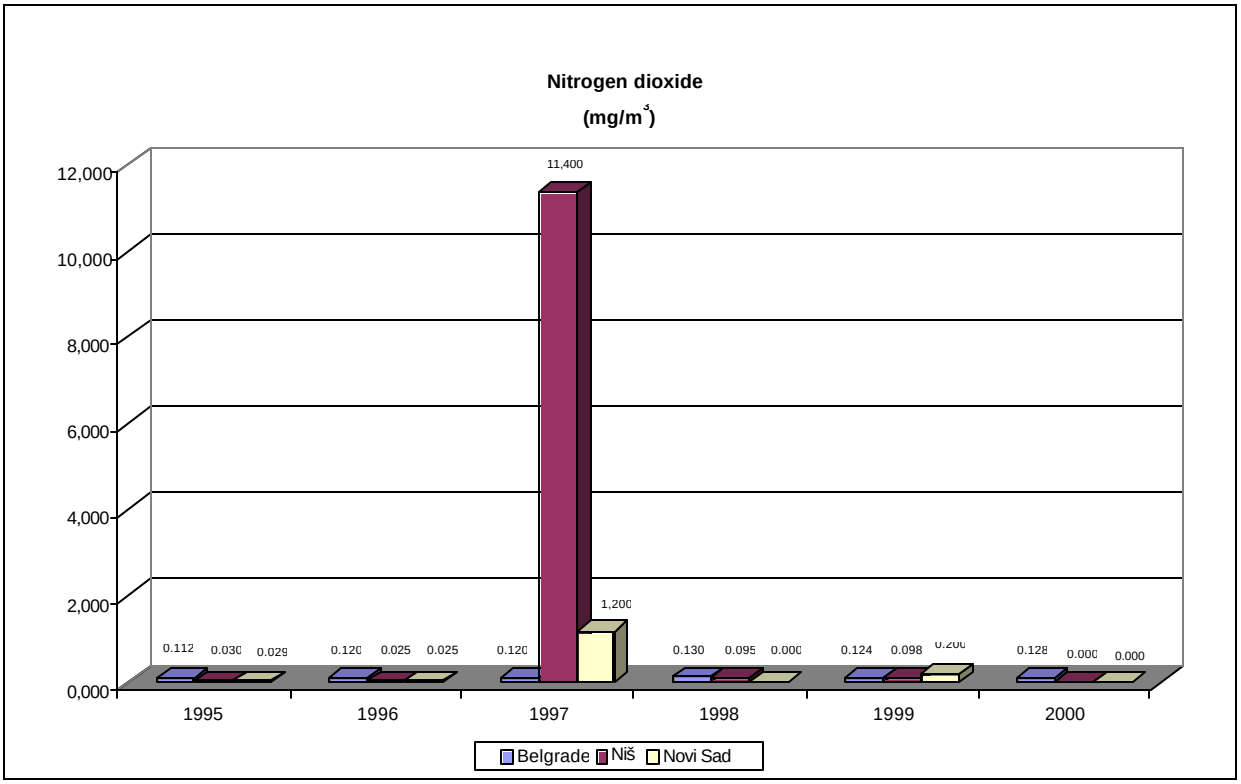
6,525
1,290
1,300
6,670
0,005
1,400
7,200
3,200
20,700
8,500
3,700
0
7,900
1,350
0.5
8,324
0
0
1995
1996
1997
1998
1999
2000
Belgrade
Niš
Novi Sad


Nitrogen dioxide
(mg/m3)
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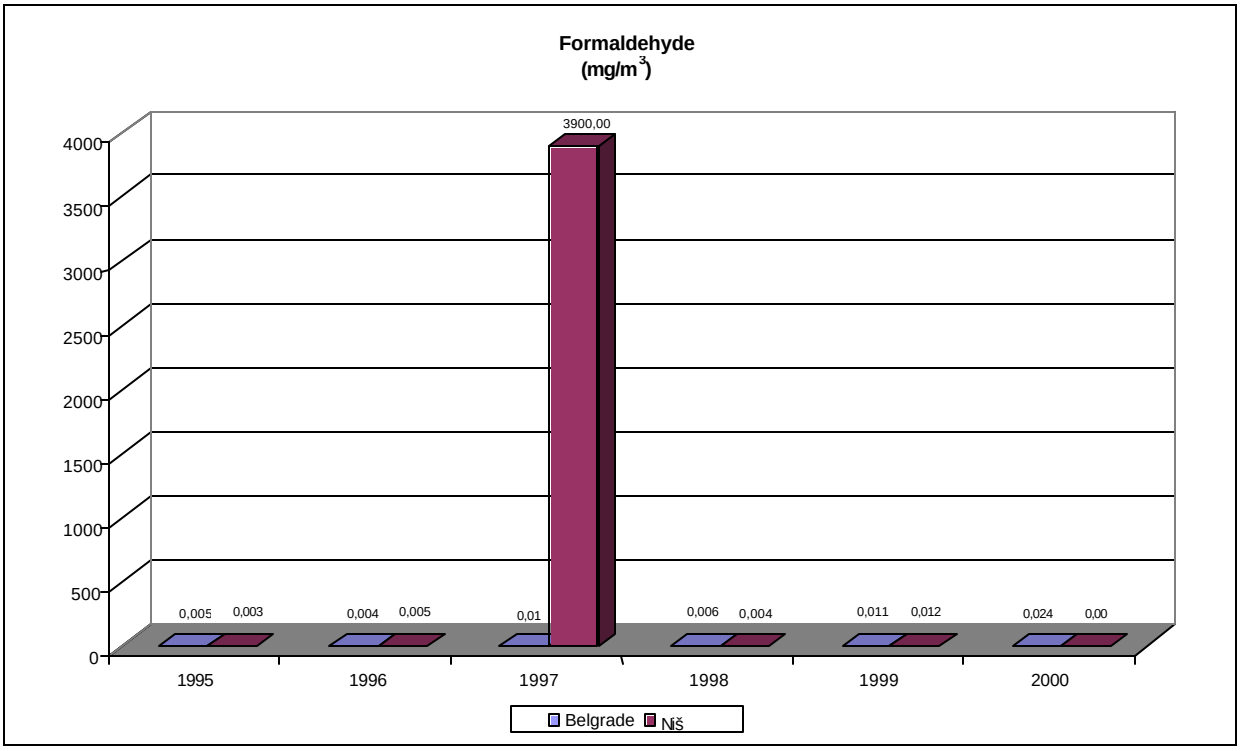
10,000
8,000
6,000
4,000
2,000
0,000
11,400
1,200
0.112
0.030
0.029
0.120
0.025
0.025
0.120
0.130
0.095
0.000
0.124
0.098
0.128
0.000
0.000
1995
1996
1997
1998
1999
2000
Belgrade
Niš
Novi Sad


Formaldehyde
(mg/m3)
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3500
3000
2500
2000
1500
1000
500
0
3900,00
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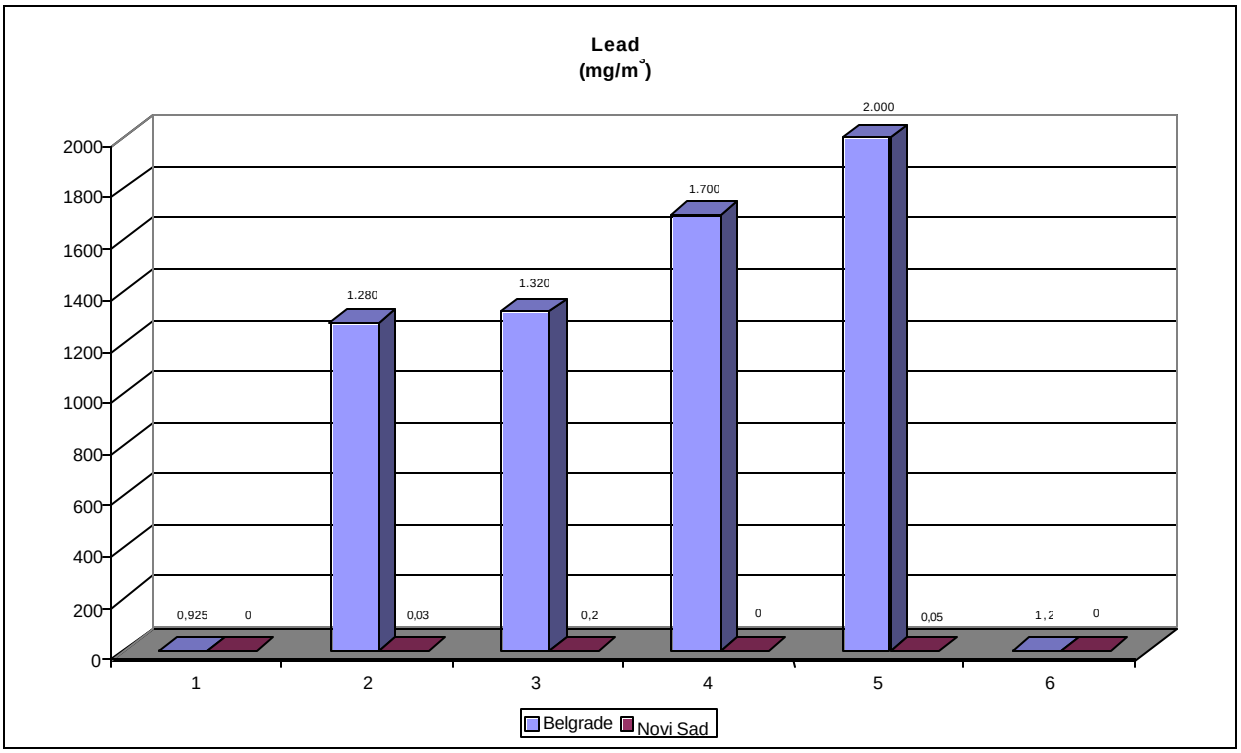
0,003
0,004
0,005
0,01
0,006
0,004
0,011
0,012
0,024
0,00
1995
1996
1997
1998
1999
2000
Belgrade
Niš


Lead
(mg/m3)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2.000
1.700
1.280
1.320
0,925
0
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0,05
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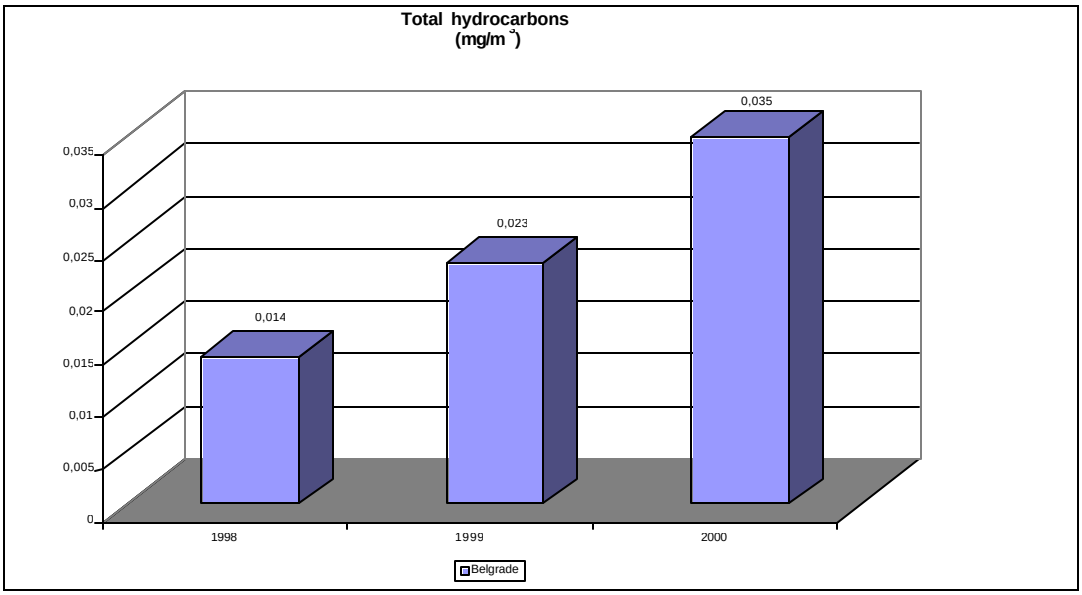
0
1
2
3
4
5
6
Belgrade
Novi Sad


Total hydrocarbons
(mg/m3)
0,035
0,03
0,025
0,02
0,015
0,01
0,005
0
0,014
0,023
0,035
1998
1999
2000
Belgrade