Improvement of transport for the “Healthy Cities” planning

Angela Mottaeva^{1,2,*}

¹ Moscow State University of Civil Engineering, 129337, 26, Yaroslavskoye Shosse, Moscow, Russia

² Moscow regional state University, 129125 Radio str. 10, Moscow, Russia

Abstract. The article considers the idea of the "healthy city", which includes transport as one of the factors, influencing health of the urban environment of dwelling. The facts on the influence of air pollutions, noise and the road accidents on the ecological situation in the cities, on the way of life and behavior of people, their physical and mental health are analyzed in the article. According to the author, it is necessary to reduce harmful effects during construction of transport infrastructure as well as during housing construction by the means of new technologies, construction and insulating materials, competent city planning, proper placement and development of transport infrastructure. Besides, the author points out the considerable potential benefits of the use of motorless vehicles, such as bicycles, or refusal of transport in favor of pedestrian movement for the environment, for health and social wellbeing of people. That in turn will demand modernization of transport infrastructure of the cities.

1 Introduction

Where people live affects their health and chances of leading flourishing lives. Two thirds of the population of the European Region live in towns and cities.

Urban areas are often unhealthy places to live, characterized by the environment damaged by anthropogenic influence, heavy traffic, pollution, noise, violence and social isolation for elderly people and young families. People in towns and cities experience increased rates of noncommunicable disease, injuries, and alcohol and substance abuse, with the poor typically exposed to the worst environments. However, there are ways to tackle these challenges [1].

Thus, the idea of the so-called "healthy cities" is demanded and very attractive.

Years ago, utopian humanists dreamed of creation of healthy garden cities with clean air, in a natural environment, favourable for life of people, and made plans of the ideal cities. Plans of creation of the ideal, healthy cities, close to the natural environment, were offered by T. Campanello ("Civitas Solis"), R. Owen ("collective city quarter"), E. Howard ("Tomorrow Garden-Cities"), etc.

Improvement and gardening of the cities is presented in works of such Russian authors as Yu.P. Bocharov and O.K. Kudryavtsev ("Planning structure of the modern city"), M.N. Bolotova and V.A. Rygalov ("Improvement of the industrial enterprises"), Ya.T. Kravchuk

* Corresponding author: angela-1309.m@yandex.ru

("Formation of the new cities"), L.E. Biryukova ("Bases of planning and improvement of the inhabited places"), I.A. Nikolayevskaya ("Improvement of the cities"), etc.

Such authors as V.V. Tabolin, V.S. Zanadvorov, A.V. Zanadvorova, V.B. Zotov, Yu.L. Hotuntsev considered the problems of management of gardening and improvements of the cities, creations of eco-friendly housing, social and transport infrastructure.

Because of development of the urbanized territories, the accelerated construction of transport infrastructure and, as a result, because of aggravation of environmental problems, the relevance of the subject increases. In 2000 the book "Planning of the Healthy Cities - the Manual of the World Health Organization (WHO) for Planning in the benefit of the Human" was published. New scientific works, including publications and proceeding under the auspices of WHO appear regularly.

The author of this article focuses the attention on one of the aspects of the healthy city - on transport and traffic. In this area K. Dora, J. Hosking, P. Mudu, E. R. Fletcher, Vukan R. Vuchic, K. Adriazola, S. Herrera, etc. have professional authority.

2 Methods

The project of the World Health Organization (WHO) "Healthy cities" was started in 1998 at the initiative of WHO, scientists and practitioners in the field of public health care. Nowadays this project is developed in many cities of Europe and considered to be the way for introduction of the principles of United Nations strategy "Health for everyone". The base for this initiative was in the middle of the 1990-th, when the European network WHO "Healthy cities" participated in the Campaign "European Steady Cities". In 1998 WHO began to carry out its regular work with experts in the sphere of city planning and scientists. The project is being implemented by 5-year phases.

The initiative of WHO of healthy cities planning recognized strong belief that the general city planning and development of transport exerts considerable impact on the defining factors of health. There is also the understanding that attempts to change personal behavior without change of social-and-economic conditions and state of environment will not be successful. Since the IV phase of the project of the European network WHO "Healthy cities" the attention is concentrated on the need of ensuring health by the means of planning of the healthy cities [2, 3].

For 30 years the WHO European Healthy Cities Network has brought together some 100 flagship cities and approximately 30 national networks.

The flagship cities interact directly with WHO/Europe, while the national networks bring together cities in a given Member State. In both cases WHO provides political, strategic and technical support as well as capacity-building.

Together the flagship cities and national networks cover some 1400 municipalities.

As for Russia, the "Healthy Cities, Areas and Settlements" Association which is carrying out the activity, aimed on the improvement of the state of health and quality of life of the Russian population, achievement of physical, mental and social wellbeing of urban and rural settlements, was founded on October 21, 2010. Nowadays 24 cities participate in the "Healthy Cities, Areas and Settlements" Association, including: Balakovo, Veliky Ustyug district, Kotlas, Cherepovets, Nevinomyssk, Ulyanovsk, Novosibirsk, Dimitrovgrad, Stavropol, Kadnikov, Chagodoshchensky district, Vologda, Petrozavodsk, Nyuksensky district, Yakutsk, Izhevsk, Pskov, Stupino, Cheboksary, Novocheboksarsk, St. Petersburg, Nikolsky district, Oktyabrsky district, Tarnogsky district.

The cities, wishing to enter the European network of WHO "Healthy cities", undergo each 5 years accreditation based on the application for participation in the project. In general, the Project monitors the condition of "health of the cities" in 6 main directions [2, 3, 4].

- economic-and-social situation;

- state of environment;
- safety;
- social support of the population;
- participation of inhabitants in management and development;
- the population health.

The model list, recommended by the National Civil Union, includes the following indicators of the healthy city [5]:

- 1) Health: indicators of incidence and mortality as well as other medical-and-demographic indicators, assessment of medical care, population engagement in sports, alcohol consumption, etc.
- 2) Family income: share of families, living below the poverty border, unemployment, grants, etc.
- 3) Housing, its quality, need for housing.
- 4) Food provision and quality of food.
- 5) Care of children: preschool institutions, day-care centres at schools, playgrounds.
- 6) Education: literacy assessment for children, share the youth, going to the universities, special educational programmes.
- 7) Work for teenagers.
- 8) Public transport
- 9) Public safety: statistics of crimes and accidents, polls.
- 10) Environment: assessment of air and water pollution, measures for water purification and waste disposal as well as "ecological education" at schools.

Analysing this list, we understand, that transport is one of the factors, influencing health of the urban environment both directly and indirectly. Respectively, much attention has to be paid to planning and development of transport infrastructure.

Several methods are used for the assessment of the state of transport as the aspect of the “healthy city” (Table 1).

Table 1. Examples of the methods, used for the transport infrastructure assessment [5].

Methods	Research
SWOT	Strategic review of the transport matters in the Republic of Ireland
Points and parameters of the importance	"The corridor rating mechanism" in Greece, Ireland, Portugal
DELTHI	Forecast of the telemechanical technologies development for transport (in 2015, for the European medium cities)
Small selective inspections of the traffic participants	Assessment of the Central Asian transport projects

3 Results

Studying of transport within the urban environment induces us to conclude, that it plays a double role.

Transport exerts considerable impact on the human health, and the development of the transport system can promote improvement of health or, on the contrary, increase risks for health.

On the one hand, the developed transport infrastructure promotes comfortable life in the city. The availability of the place of work, official institutions, facilities of health care , education, culture, sports; timely rendering emergency medical service and life of citizens itself depend on transport. Less known, but important fact is the advantage for health, which is possible for providing, if movement is accompanied by some volume of physical activity,

for example, with trips to work by bicycle or with fast walking (15–20 minutes daily) in the intervals between stops or stations.

On the other hand, the infrastructure, improving the access to one vehicle (namely to motor vehicles) quite often creates barriers to those people, who travel by other vehicles, for example, by trains, buses, bicycles or on foot. In addition, it, in turn, can lead to great disproportions in the access to the facilities of the health care system, education, places of employment and opportunities in the choice of food and to restrictions of mobility for many groups of citizens – and all these factors influence health.

Transport itself generates some negative factors:

- Transport noise
- Transport accidents and injuries.
- Air pollution generated from traffic and serious health impact of air pollution
- Climate change. Greenhouse effect.
- Change of the ecosystem
- Effects of transport on physical shape (insufficient physical activity, obesity, infectious diseases, other problems with health), mental health and wellbeing

The author will consider some problems and their probable solutions in details.

Transport noise.

Transport is the main source of noise pollution in the European cities, and road traffic, the major cause of human exposure to noise, except for people living near airports and railway lines. Ambient sound levels have steadily increased, because of the growing numbers of road trips and kilometres, driven in motor vehicles, higher speeds in motor vehicles and the increased frequency of flying and use of larger aircraft. Noise is a problem in Europe; it is the only environmental factor for which complaints have increased since 1992. Construction of new roads constantly aggravates this situation. Impact of noise from transport causes the high level of stress, elevated blood pressure, risk of cardiovascular diseases, some types of oncology, aggravation of psychological problems. It can cause not only stress, but also development delay of children, decrease in abilities to mathematics, later skills of reading [5, 6].

Technological improvements, such as low-noise road surfaces and vehicles (particularly tyres on cars), have the potential to help manage the traffic noise problem. Further, the impact of noise can be modified through noise insulation in the construction and design of buildings. Examples include using particular types of windows and roofs and the locating of bedrooms at the rear of buildings, away from noise sources [4, 5].

Transport accidents and injuries.

Road accidents cause about 1.5 death and more than 50 million injured citizens annually. The road and transport traumatism is connected with traffic offense, alcohol intake, drugs, medicines taken, the use of mobile phones or neglect individual protection equipment. Besides, the road and transport traumatism is also influenced by some city planning aspects: planning of streets and roads, conditions for pedestrians and cyclists. Statistically the greatest part of victims in transport accidents are car occupants, pedestrians take the second place (Fig. 1).

It is necessary to not only toughen rules and correct behaviour of participants of traffic for the solution of this problem. It is important to organize the transport system so, that it would consider the vulnerability of a human body and would help the participants of the traffic to cope with difficult situations. It is necessary to create city residential zones with the speed of traffic no more than 30 km/h, technical barriers and designs to cut down traumatism, to eliminate obstacles to routes of active (not motor) trips (that will reduce danger of injuries, harm from the inhaled emissions and will stimulate refusal of the car in favour of foot or bicycle walk). The increase in number of pedestrians and cyclists in turn will result in the effect of "collective security", calm of traffic, reducing the burden for the environment.

Fig. 1. Distribution of deaths by type of road user in the European Region, CIS and EU (Source: European facts and the global status on road safety, 2015, Copenhagen, WHO Regional Office for Europe, 2015, http://www.euro.who.int/_data/assets/pdf_file/0006/293082/European-facts-Global-Status-road-safety-en.pdf) [6].

Additional attention has to be paid to the public transport: creation of the allocated strips on roads, construction of convenient stations and stops, hubs. In comparison with private cars public transport is characterized by smaller traumatism per 1 passenger*kilometre.

Air pollution.

The pollutants, which are thrown out by transport and which make harmful effects on the environment and on the inhabitants health include: firm particles, nitrogen oxides, ozone, carbon monoxide, carbon dioxide and benzene (Table 2).

Table 2. Consequences for health, caused by the pollutants thrown by transport [9].

The pollutants caused by transport	Consequences
Black smoke, ozone, firm particles	Mortality
Black smoke, ozone, nitrogen dioxide, volatile organic compounds, concentrated particles in the air, exhausts of diesel fuel	Respiratory diseases (not allergic)
Ozone, nitrogen dioxide, firm particles, volatile organic compounds, concentrated particles in the air, exhausts of diesel fuel	Respiratory diseases (allergic)
Black smoke, concentrated particles in the air	Cardiovascular diseases
Nitrogen dioxide, exhausts of diesel fuel	Cancer
Exhausts of diesel fuel, nitrogen dioxide, carbon monoxide, sulfur dioxide, total of the weighed particles	Other consequences, including consequences for reproductive system

Such mass consequences cannot be recognized as admissible for the "healthy city" at all.

Extent of impact of different types of vehicles on the environment is not identical, that is proved on the example of CO2 in Fig. 2. CO2 or carbon dioxide is the very "greenhouse gas", which makes negative impact on the climate change.

Climate change is not only the environmental problem (more frequent storms, droughts, floods, extreme temperatures); it has the consequences for health of the person. For example, some diseases (such as shistosomeas) change their geographical arrangement because of the change of temperature and climatic zones).

Fig. 2. CO₂ emissions at average occupancy for various transport modes (Source: TERM 2016: Transitions towards a more sustainable system. Copenhagen: European Environment Agency: 2016 (<http://www.eea.europa.eu/publications/term-report-2016>) [4].

Figure 2 proves, that only bicycles are absolutely harmless. The least harmful of motor vehicles are trams and trolleybuses.

According to the carried out analysis, the motor (automobile) transport has proved to be the most dangerous from several types of city transport (from the point of view of negative impact on the environment). Nowadays the car became necessary and quite available vehicle for many people. In this regard the share of the pollutants, thrown into the atmosphere by cars, increases annually approximately for 3%, and it causes serious concerns. The motor transport takes the leading positions from the point of view of damage, caused to the environment; it is the main source of the air pollution. More than 90% of air pollution fall to its share, it is slightly less than 50% of noise influence and about 65-68% of influence on climate [7].

Environmental problems of transport in the modern city are inevitable. Nevertheless, they can be solved, if to work in a complex and globally. It is possible to designate the main solutions of problems [8]:

- To reduce emissions of the exhaust gases, having negative effect on the environment, it is necessary to improve types of fuel, to use the qualitative purified fuel. The attempts to save often lead to the purchase of gasoline containing dangerous connections.

- Development of essentially new types of engines of the motor transport, the use of alternative energy sources. Therefore, in the modern cities the electric vehicles and hybrids, using electricity began to appear more often. Nowadays there are few such models, but, perhaps, they will become more popular in the future.

- Toughening and observance of service regulations of cars. It is important to debug, provide constant and complex service in time, not to exceed a permissible load, to adhere to the recommendations concerning management.

- The ecological situation, for certain, will improve, if to develop and use the clearing and filtering equipment, which will reduce volumes of the harmful matters, allocated by the motor transport.

- Reconstruction of the engine of the car for the purpose of the increase in efficiency and reduction of volumes of the spent fuel.

- Shift in priorities from the motor transport to the use of other means of transport, for example, trolley buses and trams. The corresponding development of transport infrastructure, creation of the intercepting parkings, hubs.
- Promoting of motorless means of transport (mainly - bicycles) and pedestrian movement (walking).

4 Discussion

According to some experts, cycling and walking for transport become more and more relevant in the modern cities, since this way is capable to result in notable positive results quicker, than only work on environmental friendliness of the city transport and construction of the improved infrastructure [9]. This way is especially important for the creation of the so-called "healthy cities" as it not only will reduce the impact of the city transport on the environment, but also will promote a healthy lifestyle of the population, their physical activity, normal communication [10].

Experts name such a problems as decrease in the physical activity. The lack of physical activity causes more than 3 million death in the world annually (WHO). That is the risk factor, resulting in poor health and the factor, promoting increase in number of deaths and diseases, such, as obesity and its consequences, high blood pressure, cardiovascular diseases, diabetes of the second type and some types of oncology. Regular exposures to traffic congestion impair aggression and nervousness, depression, sleeplessness, irritation, frustration; worsens work and full satisfaction of life.

Transport also affects the social life and social environment in the city. The positive fact is that the use of cars enable people to leave cities and to settle in the suburban areas with better ecological conditions. On the other hand, there are several negative consequences. Road traffic and especially using a car causes a sort of social isolation. Table 3 presents interesting results of some research.

Table 3. Road traffic and network of social support (adapted from Appleyard and Untell).

Traffic levels	Contacts on the same street	
	Friends	Acquaintances
Light traffic (200 vehicles at peak hour)	3.0	6.3
Moderate traffic (550 vehicles at peak hour)	1.3	4.1
Heavy traffic (1900 vehicles at peak hour)	0.9	3.1

The physical activity brings benefit for health and healthy communication. Results of the research prove, that the people, making trips to work by bicycle, live longer and they are less subject to some diseases, than the people, moving by cars only. Moreover, the competent policy in the field of planning of transport in the cities promotes physical activity of citizens.

However, along with positive aspects of active movement, there are also negative moments. For example, walking or cycling in the polluted urban areas subjects people to the increased level of pollution (in comparison with those, who in the car) because of increase of breath and because of the trip duration. Such influence depends on weather, harmful emissions, and from a route, provided by the city.

Similarly, the risk of road-and-transport traumatism represents a problem for pedestrians and cyclists, as they have no protection, which is provided by a car.

Thus, the construction of bicycle tracks, pedestrian streets and paths, convenient sidewalks is required. In many countries active work in this direction is being carried out [11, 12].

In many Healthy Cities, the quality and quantity of bicycle paths increase. For example, during 5 years in the city of Nantes (France) 460 km of bicycle paths were created. In Bree Fransilyen, the green road for not motorized vehicle was constructed between 2 cities. This new axis along the road of departmental value number 21 is safe thanks to physical protection along the road and thanks to the adequate arrangement of intersections.

Active creation of walking and bicycle paths is conducted also in the Russian cities. Transport infrastructure is being modernized as appropriate [13-15].

5 Conclusion

Healthy city is first a city, which is favourable for life of all its inhabitants, where their various requirements are considered and satisfied. Transport is among the needs of the modern person, since facilitates access to work, education, markets, leisure and the other benefits and plays the key role in economic development. Nevertheless, because of noise, environmental pollution and the road accidents movement on roads costs much to drivers, passengers and other citizens, and society in general. It appears in the form of diseases, injuries, fatal cases and the damage, caused to mental health and social relationship.

Nowadays, as the result of the continuing expansion of motor vehicles in Europe, there is an important question of efficiency and consequences of the policy in the field of the land use and transport for the environment, health and society. Therefore, the main objective consists in promoting development of the alternative means of transport, which do not cause any damage to health and to the environment. That will allow to prevent negative impact of the transport systems on human health. According to the European experience, a partial transition to motorless means of transport and promoting of the pedestrian movement are quite effective. However, it is necessary to understand, that the solution of such a task from the governments will require strong commitment of this purpose and specific measures. Then promoting healthy and sustainable transport options will prevent the negative effects of current transport patterns on human health, such as those, caused by air pollution and physical inactivity.

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