URBAN TRANSPORT INFRASTRUCTURE AND SUSTAINABLE MOBILITY

DOI: https://doi.org/10.18485/arh_pt.2024.8.ch25

_ Božidar S. Furundžić

CPM Consulting, Belgrade,
Serbia, bfurundzic@gmail.com

_ Danilo S. Furundžić

PhD, Associate Professor, University
of Belgrade – Faculty of Architecture,
Serbia, dfurundzic@gmail.com

ABSTRACT

This paper concisely discusses urban transport infrastructure characteristics and how they determine sustainable mobility. Sustainable development principles, directing relations between man and his environment, become key start point of space and urban planning process. In modern cities of the third millennium, urban expansion is the inevitable future and efficient transportation systems are necessary. Infrastructure should be provided for the needs of pedestrians, cyclists and public transport vehicles. Quality, affordable and reliable transportation creates better living environment. Sustainable transport allows the basic access and development needs of individuals, companies and society to be met safely and promotes equity within successive generations. Digital technologies enable automated mobility and smart traffic management, making transport more efficient and thus reducing emissions. Intelligent transport systems will play a key role in making mobility more efficient on our roads. The promotion of walking and cycling is a simple way to reduce emissions and improve the quality of life in urban areas.

KEYWORDS _ *Urbanism, Infrastructure, Transport, Sustainable, Mobility, Serbia*

INTRODUCTION

A city does not exist without infrastructure. The unbreakable correlation between infrastructure development and urbanization is considered to be an indicator of the level of a society's development. Transport, as a part of the infrastructure, has a direct impact on the overall functioning of a city (Žegarac, 1998).

Infrastructure is the creation of civilization, necessary for the existence and development of a state. The influence of infrastructure is inevitable in every segment of a city because it is able to organize space, shape settlements and influence urban form (Korica, 2008).

Road transport, singled out as the most congested, must be organized in order to enable quick transport and meet user requirements. The most efficient form of urban transport is public transport system which has significantly fewer negative impacts on the environment and it can also increase the living standard in a city (Korica, Furundžić, 2014).

URBAN INFRASTRUCTURE

The development of waterways and roads improved transport and trade, what influenced the development of new towns and settlements located on the seashore, along the river, or lengthways road (Đokić, 2004).

The economy in a globalized world is an arena for competing cities and regions. Today, cities are drivers of social and cultural development, and as such they have the power to stimulate themselves, regions and states to grow and develop. To achieve a better position in a system determined by a network of global cities, they must be capable to strongly attract the best organizations and professionals. Each of the mentioned components of the city as a product represents individual levels of the overall experience and perception of a city.

Since the city emerged as an essential culturological creation of human society, the desire to dwell in it, as well as the assessment of its beauty, is based on aspects of a logical and technologically well-based infrastructural system which makes life more comfortable for residents (Korica and Furundžić, 2014). The progress of transport has enabled the expansion of trade and entire civilizations. Contemporary transport represents one of the most developed forms of infrastructure, which occurs in various forms and functions, and which has become a propulsive and profitable economic area (Furundžić and Petrović, 2022).

Streets are not just conduits for vehicles, but rather are an indispensable element of public space. The planning of transport systems largely depends on politics and the social system, in accordance with which we can recognize the different transport policies of developing countries and those that are developed or highly developed.

The development of transport technology has a direct impact on the morphological changes of every city, shaping the pattern of expanding and relocating urban activities. The representation and type of transport systems define the physical structure, and the degree of transport efficiency has an impact on the way and quality of life (Furundžić, Petrović, 2022). Due to global urbanization, there has been an increase in the need for movement, and the solution to meet this need has mainly involved the construction of new roads or the creation of new transport lines, making private road traffic the most dominant and most represented.

Political and economic planning decisions, made with the intention of creating a pro-car lobby, have proven to be an inefficient long-term solution. The most common consequences are traffic congestion and a lack of parking spaces, making cities less pleasant places to live, due to increased travel time and fuel consumption.

Negative impacts on the environment and human health include air and ground pollution, increased noise, the appearance of barrier effects, and reduced traffic safety. In addition, there are a wide range of socio-economic problems that exacerbate existing social inequalities.

These problems are also encountered by both developing and developed countries, to a greater or lesser extent, depending on the dominant type of transport, which depends on various factors, such as the stage of development, the degree of mobility or spatial constraints.

SOCIAL STANDARD

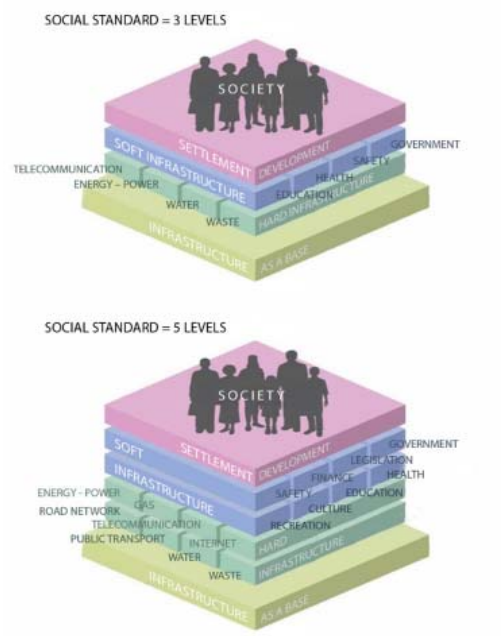

Figure 1: Infrastructure and social standard (Source: Authors)

Infrastructure represents the foundation, which significantly determines the development of the settlement and social standard. The construction of infrastructure increases both the development of the city and the social standard.

The relationship between social standard and infrastructure is illustrated in Figure 1, where the cases with 3 and 5 levels are shown. In the case of *3 levels*, hard infrastructure (telecommunication, energy – power, water, waste) and soft infrastructure (education, health, safety, government) ensure settlement development and society standard.

In case of *5 levels*, bigger hard infrastructure (road network, public transport, water, waste, energy – power, gas, telecommunication, internet) and bigger soft infrastructure (recreation, culture, education, health, safety, finance, legislation, safety, government) provide bigger settlement development and society standard.

Infrastructure includes multiple areas, networks and facilities. Created material and immaterial works are an integral part of our lives and infrastructure is a creation of civilization.

If the city is observed as a computer, it can be said that the city is a combination of hardware and

software. Infrastructure is the basis of the system, its motherboard. The built superstructure of the city is the hardware created on the motherboard. Urban life is software, whose operation and development are enabled by existing hardware.

HISTORICAL CYCLES

Social development, we assume here, takes place in *historical cycles* presented in Figure 2. The cycles include the *prosperity* (rise) and *recession* (fall) of economy. The dominant *energy source* (wood, coal, petroleum, gas) determines the development of infrastructure.

Economic crises (Banking crises, Long Depression, Stock market crash, Lehman Brothers collapse) are followed by recession. *Innovation* (high-speed rail, jet engine, car upgrade, computer) drives the way out of recession and the beginning of prosperity. The consequences are different (road expansion, railway decline, many cars, city core decay, suburban sprawl). Urbanization has own characteristics (megastructure, city renewal, globalization).

The most common consequences of many cars are traffic congestion and a lack of parking spaces. Cities become less pleasant places to live, due to increased travel time and fuel consumption. Negative impacts on the environment and human health include air and ground pollution, increased noise, the appearance of barrier effects, and reduced traffic safety.

In addition, there are a wide range of socio-economic problems that worsen existing social inequalities. These problems are also encountered by both developing and developed countries, to a greater or lesser extent, depending on the dominant type of transport, which depends on the stage of development, degree of mobility, and spatial constraints.

Global motorization has enabled higher travel speeds, urban development, and economic benefits, but also numerous problems due to overuse (Furundžić, Petrović, 2022). The type of energy required depends on the type of transport, and its exploitation has an impact on the environment and human health. Increasingly, roads do not have sufficient capacity to meet the needs of the growing numbers of private transport users.

Projects that envisage spatial expansions are often referred to as improvements, even though they can be detrimental, in the form of a reduction in the value of urban land, safety, or the mobility of pedestrians and cyclists. Efficiency is often associated with the increased speed of vehicles in traffic, although it reduces the overall traffic capacity, increases the consumption of resources, increases costs and reduces the overall economic value. Also, higher speeds can result in more serious traffic accidents. Public city transport is a response to this problem, which saves time and money, and has another great benefit that involves environmental protection due to reduced emissions of harmful gases.

The expansion of existing transport systems has been the basis of development so far, especially in the field of road transport. Modern trends reconsider this understanding, highlighting many problems that have arisen, and that require modifications in all segments of socio-economic life (Furundžić, Petrović, 2022). This ranges from spatial organization activities within the city that can have a positive impact on the use of non-motorized and pedestrian traffic, to environmental awareness and defining legislative frameworks that would enable wider use of alternative modes of transport.

In order to ensure the prosperous future of cities and their continuous development, it is necessary to adopt long-term plans. The basic criteria are: the universal approach, efficiency energy, time; safety, green mobility. Current urban growth trends indicate that urban expansion represents the inevitable future. Urbanization to date has resulted in the excessive use of private cars, the negative consequences of which we are facing today.

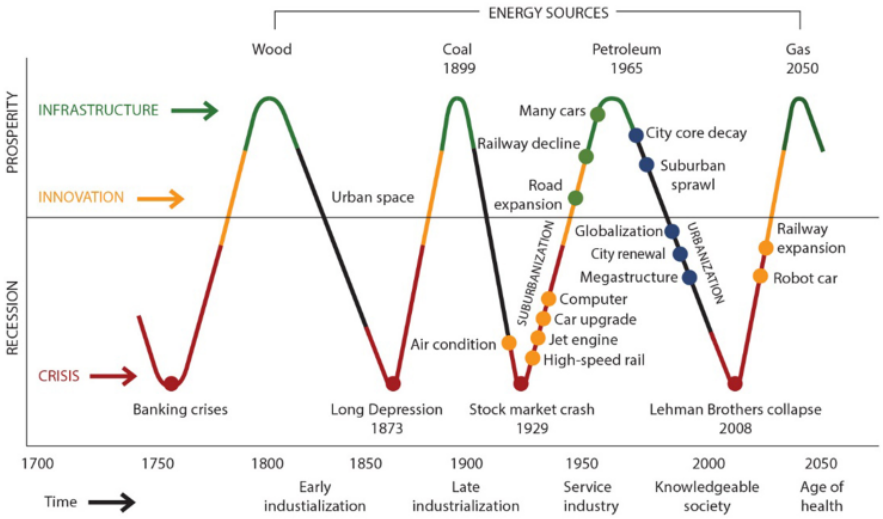

Figure 2: Social development historical cycles (Source: Authors)

Infrastructure development in East and West is presented in **Figure 3**, where abscissa is *time* [year] and ordinate is *worldwide GNP* [%]. As it is known, *Gross National Product* (GNP) is *Gross Domestic Product* (GDP) plus net factor income from abroad. GNP measures the monetary value of all the finished goods and services produced by the country's factors of production irrespective of their location.

In the past, the East (China) has higher living standard than the West (Europe). After approximately year 1850, the West infrastructure (Europe, America) rise and then fall, while the East infrastructure (Chine) rise and is going to override the West.

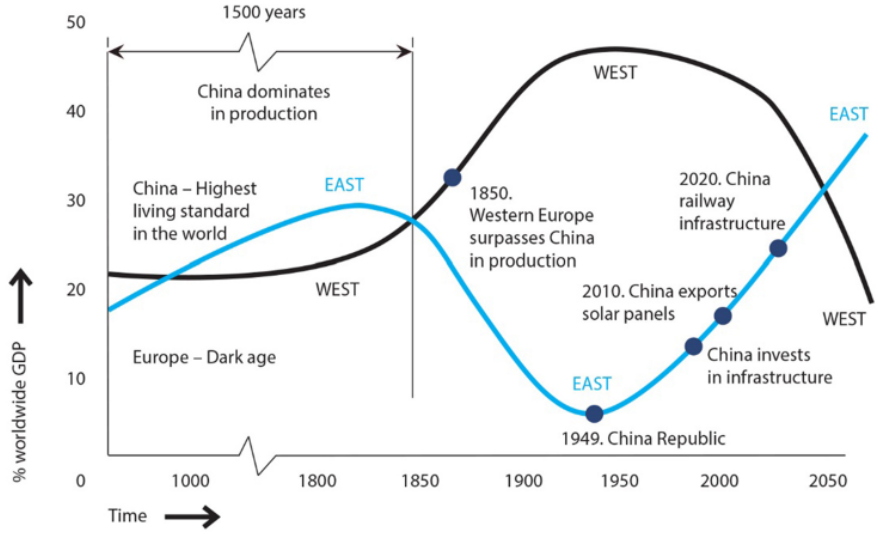

Figure 3: Infrastructure development in East and West (Source: Authors)

SUSTAINABLE MOBILITY

Rapid and unregulated development of cities in the world followed by globalization process induced high pollution of environment. Modern architecture and urbanism resolve growing ecological problems applying urban sustainable development. Sustainable development is a development which rationally uses natural and created goods, so that environment quality is protected for the present and the future generations (Furundžić, 2011). Human sustainable development enlarges sustainable development basic idea with human participation.

Sustainable development is a complex process based on the principles of justice and responsibility, which can be considered from different points of view, by applying different principles and approaches. The principles of sustainability need to be incorporated into all segments of development policy and political goals at the local and global levels, especially in transport policy, as an integral part of general economic policy.

The infrastructure, transport and urban transport planning of the future must serve sustainability. Modern cities are growing and changing constantly, with a constant need for new and more efficient transport infrastructure (Rodrigue, 2020). The need of society for the high-quality functioning of traffic is growing, but there is also less and less room for mistakes.

Innovative planning and urban practices also increasingly emphasize the importance of public urban transport and its alternative forms, such as cycling or walking, as sustainable transport systems, as well as the importance of reducing the use of private cars as the biggest polluters. The future development of cities must be planned as subordinated to the needs of the inhabitants, instead of cars.

Some of the possible measures are reducing the number of parking spaces, designing and constructing new roads, providing infrastructure for the needs of pedestrians, cyclists and public transport vehicles, and introducing a traffic ban for cars in certain parts of cities (Pinderhughes, 2004). Providing public transport that is comfortable and available would significantly increase the number of its users.

SERBIA ECONOMY

After the fall of the Berlin Wall (1989), fundamental political and economic changes occurred in Eastern Europe. Multiparty political systems replaced the communist system. The market becomes the principal mechanism for the distribution of resources, products and properties.

The transition of Serbia represents an unusual, complex, slow and delayed process. Causes of delay are internal and external (Furundžić, Jakšić-Kiurski, Petrović, 2016). A satisfactory outcome of Serbia's transition requires legal harmonisation, innovative strategies and EU financial assistance.

International investing is popular all over the world because of the chance for capital growth and risk diversification. There is a competition for foreign investment among countries in transition (Furundžić et al., 2017). Serbia tries to bring foreign companies and manufacturing industries into the country on the basis of its low wages, closeness to European markets and free trade status with both the EU and Russia.

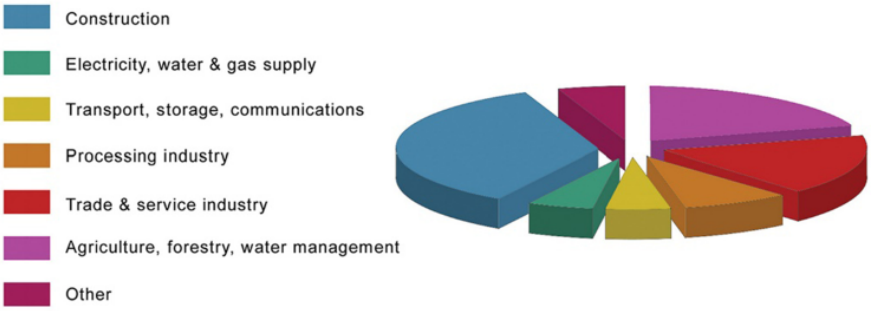

Figure 4: Economic branches in Serbia (Source: Authors)

Usual relationship of economic branches in Serbia is presented in **Figure 3**. The most developed branches are: construction, and agriculture, forestry and water management.

Landlocked Serbia, satisfactory linked with neighbouring countries, has free trade agreements and low operation costs (Furundžić D., Furundžić B., Drašković, 2019). Major sectors of Serbian economy are: agriculture, food, textile, automotive, construction, information technology (IT), tourism. These major sectors are adequately developed.

Serbia is a country of diverse rural potential. Each region has distinctive and various geographical characteristics and, for that reason, agricultural opportunities are also large and diverse. Agriculture in Serbia is at the heart of the economy and is an engine for development of rural areas. Villages produce goods for markets and agricultural industry, both national and international. But rural habitation frequent disadvantages are infrastructure lack, chaotic building and poor sanitation. Spatial and urban planning of the countryside becomes an imperative.

Global trend of migration from villages to towns did not bypass Serbia. Looking for better jobs, wages, infrastructure, housing, supplying, entertainment, and other important things, people leave countryside, and abandoned houses remain as monuments of the past (Furundžić et al., 2018). In Serbia rural areas are losing population. People move from countryside into towns looking for better jobs, higher salaries, more infrastructure, comfortable housing, easier supply, developed social life.

International trade and foreign investment, as means to penetrate markets, has grown during the last decades. The creation of new states in Eastern Europe and their transition to market countries, followed by reduction in custom duties and availability of working force not expensive, explain the growth of trade and investment.

There are great differences in wealth and development among various nations of the world. Despite existing differences, most cities have problems of air and water pollution, accumulation of solid waste, chaotic growth, traffic congestion, reduction of the amount of open space, deterioration of the quality of the environment, increase of socio-economic inequality. It is no longer enough to have just engineering knowledge and expertise to design roads, and to make algorithms and plans. It is also important to understand society as a whole, its needs and where it wants to go.

CONCLUSIONS

The urban planner must know how the city functions, but also understand its future development. Urban expansion is the inevitable future and efficient transportation systems are necessary. Infrastructure should be provided for the needs of pedestrians, cyclists and public transport vehicles. Quality, affordable and reliable transportation creates better living environments and belongs to human-sized cities.

REFERENCES

- Đokić, V. (2004). *Grad i gradski trg*. Beograd: Arhitektonski fakultet Univerziteta u Beogradu.
- Furundžić, D. S. (2011). "Ideja o održivom razvoju". [In Cyrillic]. Beograd: *Ecologica*, XVIII (62), 199-202.
- Furundžić, D.S., Jakšić-Kiurski, D., Petrović, I. (2016). "Communal Companies Merging as Smart Approach: Kikinda Town in Serbia Case Study". In: Schrenk, M., et al, *REAL CORP 2016 – Proceedings of 21st International Conference on Urban Planning, Regional Development and Information Society*, Schwechat: CORP, pp. 161-170.
- Furundžić, D.S., Furundžić, B.S., Vujović, V., Ivaniš, D. (2017). "Investment opportunities in Serbia: Kikinda case study". In: Bijedić, Dž. et al., eds., *International Academic Conference – Places and Technologies 2017*, Conference Proceedings, Sarajevo: Arhitektonski fakultet, pp. 57-67.
- Furundžić, D.S., Furundžić, B.S., Ivaniš, D.; Jakšić-Kiurski, D., Petrović, I. (2018a). "Rural Revival Financing in Serbia: Kikinda Municipality Case Study". In: Schrenk, M., et al, *REAL CORP 2018 –Proceedings of 23rd International Conference on Urban Planning, Regional Development and Information Society*, Schwechat: CORP, pp.369-378.
- Furundžić, D.S., Furundžić, B.S., Drašković, B.Lj. (2019). "Investment Locations Maping: Kikinda City Case Study". In: Molnar, T. et al., eds., *International Academic Conference - Places and Technologies 2019*, Conference Proceedings, Pecs: University of Pecs, pp.202-210.
- Furundžić, D., Petrović J. (2022). *Infrastruktura: transport – buduć*nost urbanog transporta. Beograd: Arhitektonski fakultet Univerziteta u Beogradu.
- Korica, R. (2008). *Infrastruktura, saobraćaj, urbanizam, arhitektura*. Beograd: Arhitektonski fakultet Univerziteta u Beogradu.
- Korica, R., Furundžić, D. (2014). *Nezavisni šinski sistem – Metro sistem – Projekat Beogradskog metroa*. Beograd: Arhitektonski fakultet Univerziteta u Beogradu.
- Pinderhughes, R. (2004). *Alternative Urban Futures: Planning for Sustainable Development in Cities throughout the World*. Maryland: Rowman & Littlefield Publishing Group.
- Rodrigue, J-P. (2020). *The Geography of Transport Systems*, Fifth Edition. New York: Routledge.
- Žegarac, Z. (1998). *Infrastruktura*. Beograd: Geografski fakultet Univerziteta u Beogradu.