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The city, its inhabitants and the urban living environment in the conditions of advancing motorisation (an example of Poznań)

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Abstract. When observing the development and operation of modern cities, one can quickly come to the conclusion that in the recent years the chief factor of the spatial-structural transformation of cities in Poland (though not only there) and the spatial behaviour of their residents has been motorisation, and more precisely, the car. This is so because the car, while facilitating and intensifying mobility, makes it possible to draw places of residence apart from those of goal implementation. The ever-growing number of cars moving around a city leads to disturbances in street traffic, makes the service of residents worse, causes many road accidents, and brings about unfavourable qualitative changes in the environment. That is why in many recent conceptions of urban development there appear measures intended to restrict the use of cars, which is one of the ways leading to the construction of 'a city for people'. This paper presents the effect of motorisation on modern cities as documented by statistical data concerning Poznań, one of the largest and oldest Polish cities.

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Contents:

1. Introduction

It seems easy to prove that in the recent years the chief factor of the spatial-structural transformation of cities in Poland (but also elsewhere) and the spatial behaviour of city dwellers has been motorisation, and more precisely, the car (Berg van den et al., 1982; Sassen, 1991; Parysek, 2012; Parysek, Mierzejewska, 2013). This has been happening since the late 19th century, when Gottlieb Daimler constructed the first combustion engine, Carl Friedrich Benz put it in a three-wheel car he had built, Wilhelm Maybach added a fourth wheel to the car and a carburettor to the combustion engine, and John Boyd Dunlop equipped wheels with pneumatic tyres. Although in many modern ideas, conceptions and models of urban development emphasis is put on the anthropocentric orientation of urban spatial-functional structures, it is hard to see measures of this type reflected in the urban development currently taking place. The car is still regarded as the causative urbanisation factor, especially in two stages of this process: de-urbanisation and suburbanisation (Berg van den et al., 1982). In this way, cities turn not into places for people, as some scholars and planners would have it, but for cars (Sheller, Urry, 2002; Gehl, 2010; Parysek, Mierzejewska, 2013).

The goal of this article is to demonstrate to what extent the car (motorisation) influences the spatial structures of Polish cities, what it is for their residents, and how it affects the quality of the urban living environment. General reflections will concern the situation in the cities of the contemporary world, while details will mainly be provided from Poznań, one of the largest and most 'car-saturated' Polish cities (Beim, 2011; Zajac, 2014). The data supplied in section 6 (Motorisation in Poznań) that document the views presented earlier concerning the effect of motorisation on the mobility of the city's inhabitants, its spatial-structural transformation and the urban environment, come from a research conducted under the National Science Centre project *Life of a city: A study of Poznań*, as well as from a set of input data and a two-volume book (Parysek, Mierzejewska, 2013; 2014). The numerical data and indices quoted in this chapter were obtained in the course of a survey analysis carried out in 2012 on a sample of 1,008 adult city inhabitants (persons aged 18 and older). Other data come from the organisational units of the Poznań City Office, institutions operating in Poznań, and the data bank of the Central Statistical Office.

2. The city and its development

Without progress in the technical means intended for people's movement (means of transport), there would be no dynamic spatial development of cities and no change in their structures. Movement on foot, on horseback or by bike could not ensure efficient travel from places of residence to ever-more-distant places of work and other destinations. Shifts within a city were first facilitated by trains, but they ran along fixed routes and were accessible only in certain places (stations and stops). It was only the invention of the car and the development of motorisation, primarily individual, that made it possible to move from one place to any other without much trouble. While an important role in the movement of city residents, especially over longer distances, is sometimes played by mass rail transit (train, metro, tram), and over short and medium distances – their own legs and bikes, in Polish cities the role of the car (a passenger car, to a lesser degree a bus) as a means of travelling distances keeps steadily growing. It is believed that until 1850 we had cities of pedestrians, in the years 1850–1950 cities of public transport, and then there started to develop cities of the car, this process still advancing, also in Polish cities (Newman, 2007).

While cities still tend to sprawl, generally along chief exit roads, the accessibility of places that the car ensures clearly changes this tendency, which practically means the development of a city in any direction possible. In this way, the car affects the spatial pattern and operation of the city by 'pushing' the place of residence farther apart from places of work, relaxation and the implementation of other goals (Sheller, Urry, 2002). No wonder, therefore, that increasingly popular is the opinion that the spatial structure of cities is not shaped with a view to the needs of residents, but of cars (Sassen, 1991).

The planning of the spatial development of today's cities and suburban areas affects not only the spatial-functional structure of a city, but also of its agglomeration by generating the development of a road network and the directions and intensity of residents' movement. Perhaps it is for those reasons that the car is perceived as a source of many problems in the operation of the city that its authorities have to cope with. For the authorities, the practically uncontrolled development of motorisation is a challenge in such fields as the construction of new roads and the modernisation of the existing ones, the rebuilding of the existing transport system, a new organisation of traffic, measures for making it more efficient, improvement of the safety of motorised people and pedestrians, the construction of car parks, the operation of public-order services (the police, city guards), emergency services, hospital emergency wards, improvement in the purity of air, etc. An increase in the number of cars also leads to the construction of new petrol stations, service stations and repair workshops, car showrooms, storage yards for cars sold, etc., for the location of which suitable places have to be found, preferably near a main road.

The rapid development of motorisation in Poland affects not only the spatial development of cities, but also the suburbanisation process, especially its dynamics and spatial dimension (Parysek, Mierzejewska, 2013). And while the car indeed helps many people to move around a city and conduct an activity, as a means of transport it poses a problem for the efficient operation of the city as a whole (a system). Regrettably, today the spatial structure and communication patterns of Polish cities are being designed almost exclusively with a view to the needs generated by cars moving around a city. Given this tendency, it is hard to find effective measures taken by the authorities of Polish cities that would restrict the use of passenger cars, which would be especially desirable for a variety of reasons. The historically established layouts of many Polish cities do not favour solutions that could limit and improve wheeled traffic. What is more, the traffic building up in tight city centres seriously hampers the movement of privileged vehicles (ambulances, patrol cars, fire engines, cars of power, gas and water-supply emergency services) as well as buses, which makes the level of service and safety of city dwellers clearly worse. This situation also hinders the movement of the disabled, perhaps less because of the wheeled traffic itself than because of how it is separated from pedestrian traffic (Taylor, Józefowicz, 2012).

3. Residents and their mobility

One of the features characterising the spatial behaviour of a population, especially urban, is its movement in space, or mobility. What is more, with advances in civilisation and culture as well as the spatial development of towns, one can observe an increase in the intensity of residents' movement caused by a variety of factors. Those that seem to influence their mobility today are primarily: (1) the spatial structure of a city, (2) the needs and necessary activities of its inhabitants, (3) the distance between their places of residence and places of goal implementation, (4) their material situation and social disparities, and (5) organisational, technological and economic possibilities of movement (Parysek, 2013; Parysek, Mierzejewska, 2013).

The distance between people's places of residence and those of goal implementation connected with the spatial structure of a city generates their mobility, and the city's spatial structure determines directions of their movement, its intensity, duration in time, and cost. The needs of individual persons, the necessity to travel distances, and the social status determine goals the achievement of which requires concrete movements allowed by the available means of transport, including one's own car. However, movement directions do not follow solely from the spatial structure of a city, but also from people's perception of this structure (Wlamsley, Lewis, 1984; Parysek, 2013; Parysek, Mierzejewska, 2013). Their individual preferences as to the choice of places of goal implementation are also of some importance. Basic spatial relations of movement involve such places as home, work, school, shops and service stations, places of religious practices, leisure facilities, cultural events, entertainment, social contacts (places of residence of the family, acquaintances, friends), etc. The spatial dimension of mobility also depends on such socio-demographic factors as sex, age (the stage in the life cycle), civil status, family status, education level, wealth, health status, interests, ways of spending leisure time, and probably

also other factors (Korcelli, 1974; Jałowiecki, 1972; Pickvance, 1973; Matykowski, 1990; Parysek, 2013; Parysek, Mierzejewska, 2013). The causative role of needs and necessary activities is determined physiologically and is connected with the operation of a household, while social status determines the nature of movement required by a concrete goal, and sometimes also the possibility of movement itself. And technical-economic possibilities of movement mean transport facilities than can be used in its accomplishment.

What should be clearly emphasised here is the systematic increase in the importance of the means of transport, especially the car, in shaping spatial interactions as manifested by people's mobility. This embraces both transport networks determining fast movement between two points in a city and the means of transport that allow reducing the time needed to cover concrete distances (Domański, 2012). The expanding and increasingly diversified spatial structure of Polish cities offers a much greater choice of places of goal implementation; to a lesser degree, of places of residence. This situation helps people to rationalise and even optimise their movements, with more free time and lower travel costs as a result. Alas, the tendency of town planning to separate areas performing various functions, which in European cities followed from the provisions of the Athens Charter and in Poland from the housing-estate type of residential construction and the model of intra-urban industrial areas adopted after the Second World War, have led not only to a distinct 'channelisation' of the population's spatial movement in a city, but also to the 'channelisation' of its transport problems (Domański, 2012).

4. The car and motorisation

As has already been stated, an increasingly important role in the mobility of city dwellers is played by the car. It allows and helps them to move fairly freely, to reach places of goal implementation, and thus to organise their family and occupational lives, to spend their leisure time in an attractive way, to get to a holiday site, etc. In this way, it expands their activity space because it allows them to operate at any hour of day and night and to move in any direction. Many residents of modern, especially Polish, cities cannot imagine a life without a car, which is treated as a measure of some sort of its owner's material situation, social position, prestige and wealth, though often acquired at a cost of many sacrifices, heavy debts including (Parysek, Mierzejewska, 2013). As a means of movement, the car is a symbol of freedom and independence (Sassen, 1991). It is this vehicle that has fundamentally changed, and keeps changing, the spatial pattern and operation of a city and that increases the mobility of its residents (Sheller, Urry, 2002; Kronenberg, Bergier, 2010).

But this role of the car has also contributed to the emergence of new ideas of the development and structural transformation of cities, including that of the so-called 'city for people'. A city in which predominant movement is on foot, by bike and by public transport, its numerous public spaces living through the functions they perform and thriving with the presence of its inhabitants and guests, which additionally enhances the safety of people and property (Jacobs, 1961; Gehl, Gemzoe, 2004; Low, 2007; Newman, 2007; Gehl, 2010). Some elements of urban development contained in the 'city-for-people' idea can also be found in other conceptions of the spatial structure of cities, like smart growth, new urbanism, MILU (multifunctional intensive land use), or urban design (Allen et al., 2007; Barnett, 1982; Carmona, Tiesdell, 2007; Dale, 2003; Downs, 2001; Duany et al., 2001; 2003; Filion, 2003; Domański, 2012; Modrzewski, 2012; Parysek, 2012). Another, new look at urban development is also offered by the New Athens Charter adopted in 2003 and the Leipzig Charter recommended by the European Commission, which are supposed to 'improve' the existing spatial structure of cities by making them more resident-friendly.

As has been mentioned, today many residents of a city and its suburban zone cannot imagine life without a car, which facilitates mobility and thus helps them to arrange many matters efficiently (though not always: congestion), especially when they involve covering sometimes great distances. At the same time, many see the car as a source of serious problems for a city, e.g. as a factor worsening sanitary conditions and causing residents to lose their free time (Gehl, 2010). This significant feature of social life (not only of city dwellers), i.e. ever greater mobility, is transformed by the car into

a combination of elasticity and compulsion, allows calling modern urban communities of the Euro-Atlantic civilisation (though not only of this area) "civil societies of automobility" (Sheller, Urry, 2002). With the development of motorisation and the design of spatial-functional patterns of cities intended to accommodate ever heavier wheeled traffic, the opinion about the exclusion of pedestrians in modern cities is formulated ever more frequently and more explicitly (Sheller, Urry, 2002; Gehl, 2010). This exclusion especially concerns the disabled, the elderly, and people with small children, but increasingly also physically fit ones (Taylor, Józefowicz, 2012).

5. Quality of the urban living environment

The car in a city is not only a factor of its development as well as structural transformation and operational problems, but also a factor lowering the quality of a broadly understood urban environment. Despite technical and technological advances (new engine generations, reduction in unit fuel consumption, catalysts, filters, etc.), fuel combustion necessary for the operation of car engines is still a source of air pollution. Car traffic, despite systematic improvements, is also a source of much noise, vibrations, and dust. The nuisance of exhaust fumes depends on the car engine (its kind, age, technological advancement, capacity, technical condition), the fuel used, and velocity. In 2007, the CO_2 emissions of a car running at an average speed ranged from 104 to 499 g/km (Hickman et al., 2007). The highest figures, obviously, were recorded in the case of sports cars (Ferrari Superamerica – 499 g/km; Bentley Arnage R – 495 g/km); very high for all-terrain vehicles (Land Rover Discovery – 354 g/km); high for luxury cars with high-capacity engines (Ford Mondeo – 218 g/km; BMW – 196 g/km; Lexus Sustainable – 191 g/km); and low for cars with low-capacity engines (Honda Civic 1.3 – 109 g/km; Toyota Prius 1.5 – 104 g/km). Generally, Japanese cars produce less, and American cars more exhaust fumes than European ones, taking into consideration cars of similar engine capacities and disregarding luxury sports vehicles manufactured in Great Britain, Italy, Germany, the USA, and Japan (Hickman et al., 2007).

The increase in the number of cars moving around city streets undoubtedly diminishes the safety of those living there and pedestrian users of those streets. In spite of the various organisational measures taken by city authorities and preventative ones taken by the police, the number of road accidents and collisions is still high. While movement in a car enhances personal safety, especially in cities with high crime rates, the car itself tends to be an object of theft, often connected with a threat to health and life (Kronenberg, Bergier, 2010).

The construction of new roads, public car parks, centres of car sale and technical service, petrol stations, etc., enforced by advancing motorisation unavoidably leads to such investments taking up free urban lots, commandeering public spaces, and reducing biologically active areas. The effect is a general deterioration in the quality of the urban living environment, which becomes less and less friendly to residents, especially pedestrians (Low, 2007; Parysek, Mierzejewska, 2013).

Thus, there are good reasons to speak of so-called external costs of car use in a city that have to be paid by its authorities, and in fact by its residents (Kronenberg, Bergier, 2010). No wonder, therefore, that many modern urban-planning conceptions propose creating an urban environment that would be friendly to pedestrians, bikers and public transport, as has already been stated (e.g. 'a city for people').

6. Motorisation in Poznań

The above opinions about the role of the car, and more broadly motorisation, in the pattern of mobility of the inhabitants and in changes in the city's spatial structure and the quality of its living environment are documented by the results of a survey analysis and information obtained from appropriate units of the Poznań City Office. The survey was carried out in 2012 on a sample of 1,008 adult city inhabitants (persons aged 18 and older) under the National Science Centre research project *Life of a city: A study of Poznań* that had a wider scope than that covered in this article (Parysek, Mierzejewska, 2013; 2014).

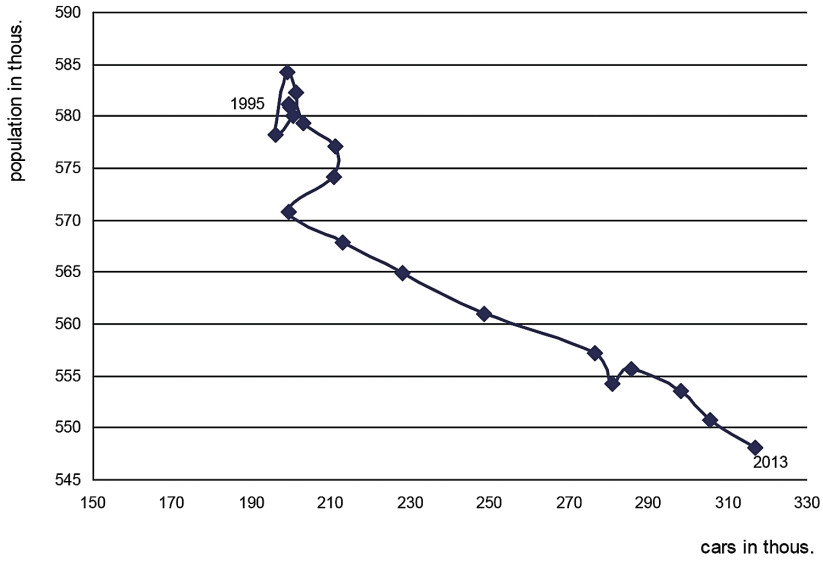

Fig. 1. Poznań residents and passenger cars in the years 1995–2013

Source: Own elaboration

In 2013, there were 316,800 passenger cars registered in Poznań, the Wielkopolska capital, being (together with Warsaw) the city with the highest number of cars per 1,000 residents, not only in Poland, but also at the European scale (Beim, 2011b; Zajac, 2014). This, it seems, is not due to the exceptional wealth of Poznań residents following from their high wages, but to the place that car ownership occupies in their value systems as well as to their thrift and frugality. It is worth noting here that the coefficient of correlation between the number of cars per 1,000 inhabitants and average wages calculated for a set of 16 Polish cities with the highest motorisation level shows the link between those features to be weak (r = 0.6368). Thus, the level of wealth accounts for a mere 40.1% of that of motorisation (R^2 = 40.55%). Among the 16 examined cities, Poznań comes second in terms of the level of motorisation and fourth in terms of wages. Other factors may include the city's spatial structure, the system and operation of its public transport, and the comfort (sometimes illusory) of movement around the city that the car ensures. An examination of the relationship between the levels of wages and motorisation also supplies information that an important factor boosting motorisation more than wages is a city's near-border location. The indicator of the number of cars in relation to wages assumes the highest values in Opole, Zielona Góra, Gorzów and Wrocław, i.e. cities in voivodeships bordering on Germany (the ease of bringing a car from abroad – Germany). In a survey research conducted in 2012, 49.1% of the respondents reported car ownership (58.0% of males and 42.2% of females). Poznań car owners are primarily younger and middle-aged people. The car is used in various situations determining the frequency of its use. 28.7% of the car owners polled declare everyday use, and 22.3%, a few times a week. Still fewer people drive a car only at weekends (9.5%), but its irregular use predominates (39.4%). Everyday car journeys characterise mainly economically active people, while at weekends the car is usually used by the youngest and the oldest ones. This would suggest that the car is used primarily in order to get to work (which is not corroborated by other results of this survey research) and to arrange various important matters. The most frequent purposes for which it is driven are shopping (17.8%), family life (17.7%), tourist-recreational events (12.5%), vacation (13%), going to work (10.6%), social life (9.5%), cultural life (7.5%), entertainment (7.4%), and driving children to the kindergarten and school (3%). But very often the car is used for several of those purposes in a single journey (Parysek, Mierzejewska, 2013).

However, the frequency of car use and the number of passengers during a journey declared by the

respondents differ from the observed data. Morning and afternoon traffic jams, crowded streets, full car parks, and vehicles parking wherever possible suggest that the car, e.g. as a means of getting to work, is used by more than the 28.7% of owners admitting it. Also, occasional observation of the number of persons in cars, especially in the morning and afternoon, leads to the conclusion that in a decided majority of vehicles (ca. 70%) there is only one person travelling. But the survey research conducted suggests that only 36% of owners travel by car by themselves, 48.5% with another person, 9.3% with two, and 6.2% with three and more (Parysek, Mierzejewska, 2013).

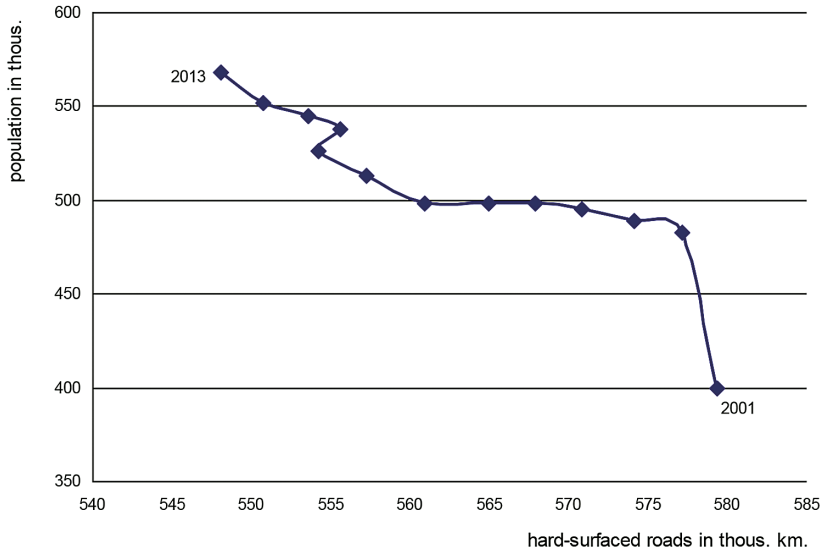

Fig. 2. Poznań residents and hard-surfaced roads in the years 2001–2013

Source: Own elaboration

As follows from the figures presented above, attachment to the car and its frequent use are characteristic features of Poznań residents. This must generate street traffic, made additionally heavier by people living in the Poznań agglomeration who commute to Poznań to work or school, or in search of various services. What does not help in limiting car use is the present network and operation of public transport and a systematically climbing cost of using this system (rising ticket prices), though here some improvement has lately been made with the introduction of the Poznań Electronic Agglomeration Card. Of no help, either, are constant alterations in tram and bus routes caused by never-ending road investments, the unpunctuality of trams and buses, the lengthening of travelling time caused by congestion and a wish to economise by reducing tram and bus courses (in particular on days free from work, especially Sunday mornings), suspending lines and reducing the frequency of courses in the holiday season, etc. Regrettably, the recent good qualitative changes in the stock (new Solaris low-floor buses and trams) have not produced an increase in the number of passengers conveyed. The number of people using public transport keeps declining steadily from year to year, which lessens its efficiency, given the high fixed costs (the network, stock, stops, technical service, traffic service, etc.). One should also add that travelling by public transport, especially late in the evening and on Fridays and Saturdays, is no pleasure and is not always safe. All this causes the car to be gaining in popularity and significance as residents' means of movement, despite the fairly high prices of fuel.

The best proof of the spatial-structural layout of Poznań being designed to meet the needs of cars, rather than people, is the steadily growing length of its roads despite a systematic decline in the number of its residents (Figs. 1 and 2), as well as the absence of pavements along many roads, a limited number of pedestrian crossings, the construction of two-level crossings, favourable for cars but an insurmount-

able barrier to the disabled, the elderly and people with prams, and preferences for car traffic rather than pedestrians in places with traffic lights. In the years 2001–2013 the length of roads in Poznań grew by 27.2%, while its population decreased by 5.4%. In other words, a decline in the number of residents was accompanied by an increase in the length of the road network (correlation coefficient r = -0.781). The number of registered passenger cars grew by 56.2%, being correlated positively with the length of roads (r = 0.651), and negatively with the population number (r = -0.958). Those indices of the dynamics and the correlation coefficients are eloquent proof that Poznań, rather than being 'a city for people', and an 'ecological' one to boot ('the city of greenery and water' as an objective of the new strategy being designed) is increasingly a city for cars. The rise in the number of cars is accompanied by a drop in the population number, which means that cars 'push' residents 'out' of the city, as indicated by the high negative correlation coefficient (Parysek, Mierzejewska 2013).

In spite of a systematic decline, there are still many road accidents and collisions in Poznań. In 2014, there were 9,504 collisions and 495 accidents in which 576 people were injured and 50 killed. And while this is an improvement over the 2010 figures (10,522 collisions and 685 accidents, with 809 wounded and 60 killed), the number of serious consequences of those events is still high (the number of wounded and killed against the number of collisions and accidents).

Cars are still attractive objects for thieves. They steal both entire cars and their parts, equipment and things transported. And though the number of stolen cars also keeps diminishing steadily (1,099 thefts in 2010 as against 1,016 in 2013), those figures are still far from desirable.

The level of air pollution in Poznań is one of the highest among big Polish cities. In the opinion of the sanitary service, most of it comes from cars, a large number of which move in the compact central part of the city and on its chief access roads: 89–92 days with exceeded standards for exhaust fumes in 2011 as against 42–51 days in 2005 (Parysek, Mierzejewska 2013).

7. Conclusion

The reflections presented above clearly show motorisation to be a causative factor in the spatial-structural transformation of cities and changes in the urban living environment. Motorisation is a process that cannot be stopped, but the use of cars in a city can be limited. With its social costs growing, this is an important task for the authorities of Polish cities; important in spite of social resistance, as indicated by numerous protests against limited car use and traffic in a city. There can be all kinds of solutions, from systemic and comprehensive to particular. The basic systemic solutions include: (1) employing new ideas, conceptions and models of urban development in planning practice that generally lead to the construction of 'a city for people', (2) working out conceptions of spatial development limiting suburbanisation, and (3) organising public transport systems that would be compatible, efficient, safe, spatially accessible (in terms of places of residence and chief places of goal implementation), and cheap. Among particular solutions are primarily measures taken by city authorities to discourage the use of the car, e.g.: (1) creating sequences of streets for pedestrians, (2) organising zones of low-intensity traffic and limited parking, (3) limiting car speed, (4) constructing paid underground car parks, (5) constructing level crossings with traffic lights giving preference to pedestrians, (6) limiting the construction of new roads to ones absolutely necessary (in accordance with the rule: more roads – more cars – heavie traffic), (7) constructing bicycle routes, (8) introducing charges for cars coming into the city centre, etc. The limitation of car use can also be facilitated by educational measures intended to raise the ecological awareness of residents, and promotional fees for the use of public transport. There may still be many other measures bringing the desired effect, especially ones possible to adopt in a concrete city.

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