

The Instruments of Urban Logistics and Mobility Management of Population

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This article aims to present the instruments of the city logistics that allow the mobility of the residents. Among them those that enable the coordination of the entire chain of movements, like *Bike & Ride* or *Park & Ride*. *Car sharing* and city transport agencies are mentioned.

Key words: city logistics, transportation, communication, mobility of individual trips.

1. CITY LOGISTICS AND THE RESIDENTS MOBILITY

Traveling within the city is becoming more and more difficult for the passengers. This results in high social costs¹ and involves time that is a good of a certain value². The time used to travel is getting longer. This is a consequence of the increasing demand for movement and the lack of adjustment to the needs of the public transport systems.

Today most frequently the choice is between public transport system or driving one's own car. Public transport is the means of transport that does not need a lot of space and is the least polluting for the environment. However this is not a sufficient argument for the residents of the agglomeration that would make them give up on individual transport. To limit individual means of transport specific actions that make the public transportation more attractive need to be taken. Here the concept of city logistics can be applied. It can be defined in

two ways as for as people flow management is concerned:

- as the total time of all journeys, that take place within scheduled time and place. These are, for example, commuting to work and school (mandatory transfers);
- as the total time of journeys undertaken at any dates (optional journeys).

Logistics-oriented city management will take care of the increasing mobility of population and the optimization of the time of their movements. Its priority should be to rationalize the flow, which consists of the time of journey and the waiting time. The purpose of this policy is to strive for minimizing the waiting time. This can be achieved through liquidation of traffic jams, or coordination of road repairs.

The main task for the city logistics is the coordination of transportation systems, which consists of making rational split between the collective and individual communication³. This division, however, requires constant comparison of different modes of transport, which will identify

¹ Including own costs and external costs (noise, pollution, congestion, accidents).

² Confirmed by a survey completed by J. Szołtyśka in 2004 in the cities of Silesia. They show that 83% of respondents choose the means of transport due to travel time. J. Szołtysek, *Logistyczne aspekty zarządzania przepływami osób i ładunków w miastach*, AE Katowice, 2005, s. 161.

³ O. Wyszomirski, *Podstawowe uwarunkowania kształtowania oferty przewozowej w komunikacji miejskiej*, „Biuletyn komunikacji miejskiej” 2007, no 87, p. 37.

those elements of the public transport system to be improved in order to increase its competitiveness.

The choice of means of transport is determined by many factors which reflect the expectations of travelers. They can be divided into the following categories:

- objective factors to choose means of communication - such as lack of convenient connections with the destination, not having a driving license;
- situational factors - such as baggage, weather;
- information - such as knowledge of the timetables of public transport and location of bus/tram stops;
- personal preferences - for example, total negation of public means of transport;
- one's own time involvement;
- financial expenses;
- image and transport equipment.

Preference surveys conducted among residents of Gdynia⁴ allowed to extract the evaluation categories of transportation systems such as: accessibility, punctuality, frequency, immediacy, low cost, velocity.

It is difficult to make the collective communication more attractive basing on evaluation criteria that differ so much. Some of them are mutually exclusive (frequency and directness), and selective modernization may not lead to expected effects in the whole system. Besides, these criteria are subject to different activities, such as setting priorities for public transport requires planning activities, and ensuring appropriate structural standards such as the construction stops - technical actions. As a result, presented a set of responses generally does not meet expectations of the residents. This is the consequence of the choice given to the passengers to name one or more of the features describing the means of transport.

Therefore, in order to improve the competitiveness of public transport it seems reasonable to propose three evaluation criteria, such as time, cost and convenience of travel (table

1). These criteria reflect the expectations of most travelers and should be the starting point for the modernization of transportation systems⁵. Any changes will be justified only if they are noticed and appreciated by the passengers.

Table 1. Criteria for comparison of individual and collective communication

Communication /criterion	Individual Car Transport	Collective Communication
Time	- Walking time (e.g. time to get from home to the car) - Time of travel - Time needed to find a parking spot - Time to reach your destination (e.g. from the parking lot to the workplace)	- Walking time (e.g. time to get from home to the bus/tram stop) - Waiting time (for the means of transport) - Time of travel If needed, time to change the means of transport - Time to reach the destination (e.g. from the bus/tram stop to the place of work)
Cost	Fixed maintenance costs (eg security) Fuel costs Parking costs	Ticket price
Comfort	Security in the car Independence, etc	Type of mean of transport (bus, tram, underground) Equipment and age of the mean of transport Consulting and Service Decor and shelter at bus stops

Source: author's own.

Improving the competitiveness of public transport is not a guarantee of improving the transport situation in the city. It is necessary to change the behavior of residents in this field. This can be achieved through deliberate use of city logistics instruments, to help to move around the city. These instruments are among others: creating multimodal passenger transport systems and central mediation of personal journeys (*car sharing*).

⁴ These studies were conducted in 1996 Read More: Grzelec K., Hebel K., Wyszomirski O. „Postulaty przewozowe mieszkańców Gdyni według badań marketingowych z 1996 r.” *Transport Miejski* 6/97.

⁵ W. Rydzkowski, K. Wojewódzka-Król, *Transport*, PWE, Warszawa 2008, p. 242.

2. MULTI-MODAL PASSENGER TRANSPORT

Multimodal passenger transport systems provide coordination of the entire chain of movements pursued by various means of transport (on foot, bicycle, car, etc.). It allows connect the trips of individual and collective communication. The possibility of such systems range from combination of car and collective communication (Park & Ride) to the cycling trips and public transportation combination (Bike & Ride).

The importance of multimodal systems increases when the residents refuse to move on foot. The smaller the ability, the worse are the roads to be used⁶. As shown in the studies conducted in Germany⁷, residents are ready to move on foot only 200 meters to reach the next bus/tram stop or their workplace. This distance should therefore be the starting point for location of public transport interchange points⁸.

People who like cycling show greater willingness to move. These people are willing to drive from 3 to even 10 km to the destination point⁹. If the distance is bigger it is where the concept of combining travel by bicycle and public transportation can be applied. It can take many forms¹⁰:

- *Bike & Ride* – by bike from home to the bus/tram stop, then public transport.
- *Ride & Bike* – from home to the place where the bicycle is parked by public transport.

- *Bike & Ride & Bike* – by bike to the bus/tram stop, continue by public transport means without a bike, and then with another bike to the workplace.
- *Bike & Ride+bicycle & Bike* – from home by bike to the tram/bus stop, with the bike by the public means of transport – and by bike to work.

System that combines journeys by bicycle and public transport increases its influence range. However, this requires the construction of so-called bicycle stations at the interchange nodes, for example at railway stations of regional and local range. Such a solution has already proven itself in many places. An example would be the Netherlands, where at each station there are a few hundreds or even thousands of bicycles. Such solutions come into being also in Poland, for example in Wroclaw, where it is planned to provide 250 spaces for bicycles¹¹.

In order to implement such a system it is also important to allow the carriage of bicycles in means of public transport. This solution is offered by e.g. CFL, the Luxembourg regional train, that offers free bicycle transport to all destinations¹². In many U.S. cities there are special racks fixed on buses allowing passengers to lodge their bicycles themselves. In Poland, however, municipal carriers mostly forbid bikes on buses or trams. The exception is Warsaw, where you can transport the bike for free by all means of transportation¹³.

In Cracow, a program called *Civitas II / Caravel* was initiated, in which 15 attractive for tourism suburban buses are equipped with racks to carry bicycles. But in order to use this racks you need to travel from the initial to the final stop. This makes this offer useful rather for tourists and not for the everyday use¹⁴.

This logistics instrument to facilitate the journeys by bike combined with public transport is addressed mainly to those people for whom time

⁶ We mean heavy traffic or lack of proper lighting.

⁷ These surveys were conducted in 2002-2008 and included a share of about 50,000 households, i.e. almost 100,000 units; *Mobilität in Deutschland*, Bundesministerium für Verkehr, Bau und Stadtentwicklung (Hrsg.), 2009.

⁸ Every citizen should live in a radius of not more than 200 meters from the bus stop.

⁹ Studies conducted by the Town Planning Office in Copenhagen show that more than half of cyclist travel up to 6 km, and 20% of respondents said they travel a distance exceeding 10 km; TERM 2001, "*Indicators tracking transport and environment integration in the EU*". Draft for review. European Environment Agency, Copenhagen 2001.

¹⁰ T. Kopta, *Integracja transportu zbiorowego z rowcowym*, „Przegląd komunalny” 2007, no 9, p. 49.

¹¹ [www.wroclaw.pl/m3375/p114976.aspx], 09.06.09.

¹² [www.wandern-in-luxemburg.de/Radeln/radeln.html], 05.06.09.

¹³ A. Buczyński, *Bike and Ride*, „Zielone Światło” 2009, no 17, p. 12 i nn.

¹⁴ M. Żalińska, *Innowacje są w modzie nie tylko na zachodzie*, „Zielone Światło” 2007, no 7, p. 12 i nn.

to reach the destination is particularly important¹⁵, and the entire distance is too long to handle on a bicycle.

The use of the *Bike & Ride* facilities can be very beneficial. For example, good bicycle infrastructure in Copenhagen means that 36% of the total traffic in the city is done by bicycles. In Cracow it is only 3%. It is difficult today to estimate how much the bicycle transport can increase. It is estimated however, that it can achieve the value of 25%. Assuming that individual transport is used by only one person, such an increase in bicycle traffic will entail 25% reduction in traffic on the streets¹⁶. This in turn will result in reduced traffic jams and increased number of parking spaces. As a consequence, this will reduce the costs of roads maintenance (less holes, longer durability of the surface) and expenditure on repairs of buildings (buildings harmed by vibrations caused by cars). Increased bicycle travels reduce petrol expenses (the profits flow back to the central budget), which may contribute to increased spending on local services. Taxes from businesses will subsidize the city budget.

The mobility management of communication can be also applied for the concept of *Park & Ride*, which combines car communication with public transport. It includes the construction of parking lots located outside downtown area, close to the public transport nodes. Parking lots are sorts of an interchange centers. The principle of this concept is to drive one's own car from home to the city suburbs and leave it on specially designated parking areas and to continue the onward journey by public transport. These parking areas are free in order to increase the attractiveness of the concept.

The purpose of creating this type of parking areas is to encourage people to give up on their own cars in the city and also to reduce traffic jams in the centers. This, in turn, improves the availability of downtown, reduces gas emissions and improves the passage of public transport.

The need to reduce congestion is most evident at the cost its arousing. And so, for example, in a city the size of Warsaw, the annual social costs of transport congestion are estimated at 3.5 billion zł. In the European Union countries, these costs reach a level of 100 billion per year, representing almost 1% of GDP of member states¹⁷. According to an American study, the congestion contributes to extension of travel time by 37%.

Park & Ride systems have been successful in Western Europe for years. Poland has also attempted to introduce them. An example would be Warsaw, where there are currently five such parking lots available¹⁸. Totally planned are about 30 objects of this type¹⁹.

Benefits from the use of *Park & Ride* are big. These are primarily:

- Smaller traffic jams – a 12 meter bus can take a number of passenger who would fit into a 300 meter long line of cars.
- A cleaner environment - motor vehicles are the biggest source of environmental contamination, producing around 15 thousands of chemical compounds. Traffic in urban areas corresponds to 40% of CO₂ emissions and to 70% of emissions of other pollutants.
- Reducing fuel consumption - the largest consumption is recorded while standing in traffic jams where 50% more of fuel is consumed.

It is considered that the expansion of *Park & Ride* is focused on achieving financial benefits for the city. It is, however, economically justified because it contributes to generate social benefits. Operating costs of vehicles can be reduced, traffic jams will become smaller and in consequence – the emissions of pollutants into the environment as well as noise generated by cars will be reduced.

The success of *Park & Ride* systems depends on proper selection of locations that allows easy and quick access to public transport. It is necessary to create conditions enabling the city to provide an

¹⁵ Too disproportionately affected by the burden of transport congestion and other external costs of transport.

¹⁶ www.masakrytyczna.krakoff.info/2010/04/14/krakow-miastem-rowerow-analiza-korzysci/

¹⁷ External costs of transport and amendment of the Eurovignette, September 2008, www.cer.be

¹⁸ The first parking lot was opened on April the 10th 2007.

¹⁹ [www.ztm.waw.pl/konsultacje.php], 09.06.2009.

attractive transport offer. Above all it is important²⁰ to:

- make separate lanes for public transport;
- make it possible for public means of transport to call the green light;
- internationalization of external costs, such as parking fees at places with heavy traffic or fees for entry to areas of congestion.

3. TRAVEL AGENCY CENTERS AS A PART OF THE CITY COMMUNICATION SYSTEM

The concept of sharing one car (*car sharing*) may be also applied by the city logistics. This approach aims to reduce the real costs of the temporary use of the car, to reduce congestion and the noise level and to reduce the amount of accidents. Car-sharing service may be informal. A group of people living in the near by agrees on a common use of a car, as well as proportional participation in the costs of its operation. It can occur in two forms:

Joint use of the car: a person A owns a car and lends it to the person B, which contributes in the costs. In this form there is a car owner and its users.

Joint car ownership: person A sells a part of the vehicle to person B, which is from now on the co-owner. In this model, everyone shares the costs and benefits.

Informal *car sharing* is not a direct instrument of the logistics of the city. Local authorities have no influence on their formation. Intentional actions of the logistics of the city can only motivate people to reduce the amount of car journeys.

From the perspective of the city's population mobility management the so called central agencies based on businesses are more important. Here local authorities can actively encourage the development of the *car sharing* organizations, and sometimes may even participate in them. These organizations are opened for all persons interested in the common use of vehicles. They usually pay a membership fee, which enables them to rent a car. The costs of use are based on the same principles as the rental. It is cheaper to own a car

in this system: for example, it frees users from the vehicle maintenance costs (inspection, services).

Within the *Car Sharing* one car is used by 10 to 15 people. In this way five cars can be replaced by one and another five may be not purchased at all²¹. Studies conducted in Germany show that people using the *Car Sharing* are more conscious in the use of the individual car and use public transport or bikes more often.

In Germany, the first *Car Sharing* organization was founded in 1988, in Berlin. Currently, they operate in almost 40 cities. Their existence has allowed a significant reduction in traffic on roads, as well as the reduction of the necessary space for parking or garage²². The increase in popularity of *Car Sharing* shows the benefits it can give. These includes:

- Reduction of fixed costs for car maintenance;
- Reduction of the workload related to car maintenance (service, inspection) – which saves time as well;
- More choice for the means of transport; *Car Sharing* organizations offer different types of cars, from small car up to vans.

Another instrument used in the city logistics management is supporting local authorities in the creation of groups of people who commute together (*Fahrgemeinschaften*). There must be special facilities created - centers (eg, in the offices of the city) which will seek people who commute to work: for example, from the same places, and that would be willing to ride together.

Even on the basis of observations it can be concluded that in most cars, there is only one person traveling. The purpose of mediation centers is therefore a better use of free car seats and a better organization of car journeys. These exchanges should not be a competition for public transport but only a supplement.

²¹ Für wen lohnt sich Car-Sharing und welche Alternativen gibt es?, [www.vcd.org/carsharing.html], 14.06.09.

²² M. W. Walsh, *Car Sharing Holds the Road in Germany*, Sustainable City, [www.sustainable-city.org/articles/sharing.htm], 12.06.2009.

²⁰ T. Kopta, *Integracja transportu...*, op. cit., p. 49.

4. SUMMARY

The presented solutions lead to the conclusion that there are many instruments for the city logistics which may contribute to the management of the population mobility. Among the most important ones are the multimodal individual transport system and the city transport agencies. The experience of the Western Europe and some Polish cities indicates that these instruments can significantly reduce traffic in the city, and change the communication behavior of its residents.

BIBLIOGRAPHY

- [1] Buczyński A., *Bike and Ride*, „Zielone Światło” 2009, nr 17 Für wen lohnt sich Car-Sharing und welche Alternativen gibt es?, [www.vcd.org/carsharing.html]
- [2] <http://dip21.bundestag.de/dip21/btd/12/083/1208300.pdf>,
- [3] Indicators tracking transport and environment integration in the EU”. Draft for review. European Environment Agency, Kopenhaga 2001.
- [4] Kęsek J., Kościelniak M., *System carsharing - nowe rozwiązanie w zakresie wykorzystania samochodu*, „Transport miejski i regionalny” 2008, nr 7-8
- [5] Kopta T., *Integracja transportu zbiorowego z rowerowym*, „Przegląd komunalny” 2007, nr 9
- [6] *Mobilität in Deutschland*, Bundesministerium für Verkehr, Bau und Stadtentwicklung (Hrsg.), 2009.
- [7] Szołtysek J., *Logistyczne aspekty zarządzania przepływami osób i ładunków w miastach*, AE Katowice, 2005
- [8] Walsh M. W., *Car Sharing Holds the Road in Germany*, SustainableCity, [www.sustainable-city.org/articles/sharing.htm],
- [9] www.wandern-in-luxemburg.de/Radeln/radeln.html
www.wroclaw.pl/m3375/p114976.aspx
- [10] www.ztm.waw.pl/konsultacje.php
- [11] Wyszomirski O., *Podstawowe uwarunkowania kształtowania oferty przewozowej w komunikacji miejskiej*, „Biuletyn komunikacji miejskiej” 2007, nr 87
- [12] Żalińska M., *Innowacje są w modzie nie tylko na zachodzie*, „Zielone Światło” 2007, nr 7.