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POSSIBILITIES FOR SUSTAINABLE TRANSPORT IN WROCLAW (POLAND)

1. Introduction

Transport, however essential to growth and socio-economic development, is becoming to larger and larger extent, not a benefit but a threat to health and human life. The negative external effects¹ generated by this sector, which are incurred not only by contractors or users but society as a whole, are becoming a global problem and cause a decrease in the quality of life. The external costs of transport can be felt at global, national and regional scale. These costs are particularly visible in places where there is a rapid increase in the level of transport, *e.g.* in urban areas. Cities are especially exposed to the negative phenomena connected with transport, which result mainly from the growth of private motorization and the inappropriate attitudes of governing bodies responsible for shaping transport policy, space, ecology, etc. Increased journey time, resulting mainly from congestion, noise pollution not only in rush hours, air pollution, accidents – all this means that contemporary city transport needs to be treated separately. Such an approach should also consider the specificity of this particular „branch” of transport,² especially the necessity of

¹ External effects can be defined as „such effects of the economic activity of producers, including producers of transport services and consumers of these services, that influence in a generally unplanned way on other members of society not participating in this activity” [Szczepaniak, 2002, 82]. External effects may have a positive or negative dimension. In the second case they constitute so called external costs that lower the level of social welfare. In the case of the transport sector, the main categories of external costs are: noise, vibrations, pollution of surface and ground waters, soil and air, as well as accidents, climate change and the necessity of acquiring land to build transport networks [Paradowska, 2006, 44].

² In reality urban transport cannot be called a branch of transport, because it is not separated in the technical sense by the application of the so called “vertical classification of transport”. The

reducing the level of private motorization. The need for sustainable transport in cities and the adaptation of the rules of its functioning to the requirements of sustainable development,³ is becoming more and more apparent. The actions of governing bodies, representatives of the world of science, and what is even more important, inhabitants themselves are becoming more and more conscious of this necessity.

The aim of this article is to present the issues of developing the city transport system in Wrocław, with emphasis placed on attempts to make the system sustainable. First, some general tools for limiting the negative external effects of transport in city centers will be presented. Next, current projects initiated by the authorities of Wrocław in the domain of transport policy will be described, together with plans for the future development of the transport system. In the last part of the article, these actions will be briefly analyzed, paying special attention to their compliance with the rules of sustainable development.

2. Public transport in cities – the possibility of sustained development

As mentioned above, one of the major problems of urban transport in the context of sustained development, is the excessive development of private motorization. In Poland the Western pattern of consumption is becoming more popular and so the number of private cars is increasing. The external costs

so called "horizontal classification of transport" can also be used, based on the criterion of the separation of territorial units, within which transport operations are carried out [Rydzkowski and Wojewódzka-Król, 1997, 220].

³ The definition of sustainable development was given for the first time in the Report of the President of the UN World Commission on Development and the Environment, Gro Harlem Brundtland, "Our Common Future" [WCED 1987]. Sustainable development has been described as "development that satisfies the aspirations of the present generation without limiting the rights of future generations to fulfill their needs for development" [*Strategia Zrównoważonego Rozwoju...*, 1999]. Whereas, according to the Act on the Protection and Shaping of the Environment of 31 January, 1980 (government records 94.49.196, with later amendments) "sustainable development is such socio-economical development which ensures access to the environment for specific societies or their citizens – both in current and future generations. This involves a process of integrating political, social and economical actions with the preservation of the ecological balance and basic environmental processes". On the other hand, according to the definition of the ODCE, sustainable development is such development that „does not threaten human health or ecosystems and fulfills the needs for the transport of people and goods, in accordance with the following rules: using renewable resources at a level below their ability to regenerate and using non-renewable resources at a level that enables the possibility of developing renewable substitutes". According to this definition, the prime aim of sustainable development is "the greatest level of development possible that is based on solid economic, social and environmental bases, both for current and future generations" [*Polityka Transportowa Państwa...*, 2001].

connected with this phenomenon have lots of negative consequences and are accompanied by the development of „urban sprawl” which leads to the further growth of private motorization [Kamieniecki, 2003]. This self-perpetuating cycle, in which other elements are also important, has to be stopped. Not only the authorities that shape transport policy in cities, but also transport users, have an important role to play in this. What are the possible solutions to this problematic situation? In reality there are many. A basic ingredient of such a solution is increasing the role of public transport (railway, tram, bus, underground and others), bicycle or in some cases pedestrian traffic and restricting the use of private cars. This can be achieved in many ways. First, the policy of city authorities in the field of the construction and appropriate development of public transportation is very important. Public transport must be responsive to the demands of inhabitants (the main demands in the field of public transport are: time, comfort, accessibility, frequency, cost, safety, speed and reliability [Rydzkowski and Wojewódzka-Król, 1997, 241]). In addition, making cycling a more attractive option, by e.g. building bicycle lanes, should lead to a change in the behaviour of transport users. Secondly, restrictions may be made on the use of private motorization, by e.g. the deliberate outlining of zones of various levels of accessibility to private cars (from complete bans to restrictions concerning speed, parking places etc.), or the imposition of various fees. The third approach involves the education of a city's inhabitants, who when they have a choice between public transport, bicycle, going on foot or going by their own car, usually choose the latter option, even when they have comfortable, cheap and environmentally-sound forms of public transport, or the distance is quite small and could easily be covered on foot or by bike with positive effects on health. In these three areas there exist a large number of detailed tools for limiting the external costs of urban transport. However, this is not the subject of this study. In the rest of this article, the solutions adopted in Wrocław, the capital of Lower Silesia (Poland), will be presented from the point of view of their conformation to the rules of sustainable development and reduction of the external costs of transportation.

3. Development of legislation connected with the sustainable development of the transport system in Wrocław

The legal basis essential for the sustainable development of urban transport in Wrocław was created at the end of the last century. The document that constituted a milestone in shaping transport policy in Wrocław, *The Basis of the Ecological Policy of Wrocław*, was passed as Resolution LII/813/98 of the City Council of Wrocław on June 5th, 1998. In Chapter III of this document, entitled *The Sustainable Development of the Transport System*, actions were

described that aimed to harmonize transport in Wrocław with the ecological policy of the city with a division into short-term (till 2002), mid-term (till 2010) and long-term (after 2010) priorities. Stress was especially put on such areas of action as:

- (i) the modernization and reconstruction of the city transport system and its connections with the external transport system from the point of view of improving traffic flow and transferring the majority of heavy transit transport and interregional traffic away from the central area of the city,
- (ii) introducing three zones in the communication and transport system of Wrocław (this also includes restrictions on the use of private motorization),
- (iii) improvement and promotion of public transport, in order to increase its share in total transport within the city,
- (iv) implementing a flexible parking policy,
- (v) decreasing the negative impact of transport on the environment through other ventures.

Although this document has a declarative character rather than being a technical plan, it is worth appreciating the awareness of the city authorities in noting the necessity of undertaking appropriate action as far as transport policy is concerned. A year after passing this document, "The Transport Policy of Wrocław" appeared as an annex to Resolution no. XII/396/99 of the City Council of Wrocław, of 23 September, 1999. This document defined the following as a general aim of the transport policy of Wrocław: „the creation of conditions that provide the efficient, safe and effective, economical transport of people and goods, while fulfilling the requirement of limiting the negative effects of transport on the environment” [*Polityka Transportowa Wrocławia*, 1999]. The main goals were defined to be: ensuring the efficient functioning of public and goods transport, providing the expected and necessary level of comfort of public transport; stimulation of the economic and spatial development of the city by making travel destinations accessible allowing inhabitants to realize their chosen form of activity and developing new elements of the transport system to make new areas of the city accessible for future investment; limiting the negative effect of transport on the environment and the city's inhabitants, including ensuring road safety; as well as decreasing the economic and social costs of transport.

In *Polityka Transportowa...* [1999] it was assumed, that the development of the transport system of Wrocław should comply with The Strategy for Sustainable Development and therefore should be based on the four following main aims [*Polityka Transportowa Wrocławia*, 1999]:

1. Influencing the growing demand for private transport in such a way as to limit it to a level which avoids congestion.
2. Providing public transport services to meet actual demand, while providing a level of services that will encourage inhabitants to use public transport.

3. Providing the most useful and socially acceptable forms of public transport.

4. Preserving the ecological balance in the whole city by attaining the appropriate division of transportation between public and private transport, in such a way that the level of traffic will not exceed the ecological capacity of the system, which will be regularly monitored.

Similarly to the priorities in The Rules of the Ecological Policy, the following tasks were outlined:

- (i) decreasing the demand for transport in the city center within the framework of coordinating transport policy with spatial policy,
- (ii) ensuring a lack of congestion in the city's basic road network,
- (iii) enhancing the attractiveness of public transport,
- (iv) assuring the dynamic development of the city by enhancing its attractiveness to investment by constructing roads which enable access to sites that constitute prime land for economic activity.

The first priority involves the development of the City Transportation System, which is to be integrated with external transport systems and also with the national railway network. The development of the road network is of particular importance, including the reconstruction and modernization of the basic road system (from radial into radial-encircling using three planned ring roads: the Motorway Ring Road of Wrocław, the City center Ring Road and the Old City Ring Road) and its expansion to enhance the attractiveness of areas of economic activity. Increasing the attractiveness of public transport should be based, above all, on an efficient tram system, since this is the most environmentally friendly form of transport. This should be supported by bus transport, which is more flexible and can make use of the road system. The expansion and modernization of tramlines, purchasing of new trams and buses and establishing the priorities for public transport should ensure a higher level of exploitation. It is worth mentioning that within the boundaries of Wrocław there are four distinct zones. In the first zone, covering the very center of the city, pedestrians will have priority, while admitting cyclists and limiting cars to the minimum number possible. In the second zone (the city center) public transport will have priority, while a modern parking policy will also be implemented. In the third zone (heavily built-up areas) „essential” transit will be possible, whereas in the fourth zone private transport will be unrestricted.

It has been 8 years since the passing of these goals and priorities for Wrocław's transport policy. During this time they have been reflected in arrangements included in other documents, including *Studium uwarunkowań i kierunków...* [2006], as well as in the socio-economic policy of the city of Wrocław, which is set each year. What is even more important – the majority of these priorities have been reflected in real action.

4. The transport system in Wrocław at the beginning of the 21st century – an opportunity for sustainable development?

The documents presented above, together with others concerning the development of the transport system in Wrocław and the premises resulting from the goals of eco-development, seem to be essential in one of the most dynamically developing Polish cities, with an area of 292.8 km² and population of about 636 thousand [*Rocznik Statystyczny...*, 2006, 31]. Wrocław, as well as other cities in Poland, is contending with the rapid growth of private motorization, which has been accelerated by Polish accession to the EU and the possibility of importing older cars from Western Europe. In 1985 the number of cars per 1000 inhabitants was 132, in 1990 it was 186 [Miklaszewski, 2002, 116] and in 1995 – 252. By 2000 this number had increased to 336 and by 2005 to 378 [*Rocznik Statystyczny...*, 2006, 39]. The development of the city's road network has not kept up with this high growth rate of private transport. In addition, spatial and environmental barriers require that this trend is counteracted and the role of public transport strengthened. As mentioned above, one of the priorities of Wrocław's transport policy is the development and modernization of the road system. Indeed, action in this area is essential, as transit through the city plays a significant role. According to the documents that describe the assumptions of Wrocław's transport policy, traffic was to be moved from the center of the city to the outskirts. This traffic could pass through zone III and without limits through zone IV. There has been no success in the implementation of this plan, which was caused mainly by delays in the construction of the Motorway Ring Road of Wrocław and the Ring Road of the City center. An absurd situation resulted from the construction of the so called „bridge to nowhere”, as it is called by the citizens of Wrocław, in other words the Millenium Bridge, which constitutes part of the Ring Road of the City center. Although the bridge has been constructed, looks impressive and makes crossing the River Oder much easier, the next part of the ring road has not yet been built. As a result, transit traffic passes through the previously peaceful and calm housing estate of Różanka.

The bad state of the roads, bottlenecks, insufficient infrastructure for public transport – these and other factors mean that it is necessary to renovate the roads and streets of Wrocław. However, these roadworks are often not finished on time. Large, long term investments carried out at a key hubs of the city transport network are very common and result in severe restrictions on traffic flow, both for private and public transport. It has not been possible to accomplish the goals of the Strategic Programme „Clearing Wrocław from Congestion – the creation of conditions for the effective, safe and ecologically friendly transport of people and goods in the city of Wrocław and its surroundings”, that constitutes part of the Wrocław 2000 Plus Strategy, which was

passed as Act no. LII/765/98 by the City Council on June 4th, 1998. However, it is likely that the majority of the road investments aimed at increasing the rate of traffic flow through Wrocław will be finished by 2010 as planned. The modernization of the road system is also important for other reasons. Historic buildings are predominant in the very center of the town and the layout and character of the streets are typically pre-World War II. It is essential to renovate these streets while both preserving their historic character and taking into consideration the needs of public transport, whenever possible giving it priority over private motorization.

The Municipal Transport Company is responsible for almost all public transport in Wrocław (100% of tram transport and about 90% of bus transport). Lower Silesia Bus Lines (LBL) and the State Road Transportation Company together supply about 10% of bus transport. It may be stated that the public transport network in Wrocław is quite well developed. The well preserved tram network is something to be proud of. The World Bank described it as „a pearl in a crown”, because of the environmentally friendly nature of trams [Miklaszewski, 2002, 16]. The total length of the network in 2004 was about 200 km. Half of this was sectioned off from the roadway [*Studium uwarunkowań i kierunków...*, 2006, 144]. At present 22 tram lines are functioning. In 2005 there were 84 km of working lines (a decrease of 5 km in comparison to 2000). There are 400 trams (this number diminished from 406 in 2000 to 401 in 2005) [*Rocznik Statystyczny...*, 2006, 309]. At the end of 2004 about 66% of the stock was obsolete – more than 20 years old [Piechociński, 2006, 3]. However, the stock is being quite systematically modernized, in order to increase the comfort and safety of journeys and decrease the level of noise emitted (e.g. by using modern systems for accelerating and braking, safe door systems, electronic devices giving passengers information, as well as aesthetic interiors) [Miklaszewski, 2002, 116]. Although the Municipal Transport Company Ltd. is planning to purchase new trams that comply with European norms and standards, ensure comfort and are environmentally friendly, from the passengers' point of view these improvements are often not sufficient. The purchase of a modern Skoda tram was a „big” event for the tram network. It was to run on a recently renovated part of the North-South Cross-town Tram Line (the project was co-financed by the EU as a part of the IOPRD), but because of technical problems it had to be withdrawn from this route and after introducing it on a new route, constant breakdowns forced the MTC to withdraw the tram for „an indefinite period” [Infobus, 2007; *Przebudowa Średnicowej Linii...*, 2007]. As a result, the image of the MTC and Wrocław tram network, which had previously been quite positive, was damaged. This was augmented by the chaos caused by constant renovation, plans for the expansion and modernization of tram routes, as well as changes in the network resulting from renovation work. As a result, the users of the public transport system are confused and do not know what to expect.

Wrocław also has a dense network of bus lines. Initially, the plans for improving Wrocław's public transport system were based on extending and modernizing the tram network. However, as written in *Studium uwarunkowań i kierunków...* [2006], the character of the bus network means that it does not just complement the tram network, but is also a parallel, independent network". The bus network consists of 58 lines, including 13 night lines, 33 regular lines, 6 express lines, 4 rapid lines and 2 rush hour lines [*Historia MPK we Wrocławiu*, 2007]. The stock consisted of 398 buses in 2005 (a growth of 51 in comparison to 2000), whereas the length of active bus routes was 546 km (a growth of 213 km in comparison to 2000!) [*Rocznik Statystyczny...*, 2006, 309]. Almost 140 new buses were purchased in the period 2001–2005. They are modern, with low floors, well-equipped, environmentally friendly, durable and economical [*Zintegrowany Plan Rozwoju Transportu...*, 2006, 53]. How can we explain this rapid development of bus transport, although 10 years ago the city authorities were mainly interested in the development of the tram network? It seems that the crucial factor here is the flexibility of the bus network. It uses the already existing road network, without the need of developing or modernizing it. New lines can be introduced that satisfy the growth of demand for transport resulting from the rapid development of Wrocław's suburbs. In addition, the stock of buses is being modernized and the new buses either fulfill the Euro 1, Euro 2, and Euro 3 norms on fume emissions, or have catalytic converters. These buses emit less noise, ensure increased comfort and are also adapted to the needs of disabled people. The MTC of Wrocław attaches great significance to ecology, uses fuels with a lower quantity of toxic elements than is found in normal engine oil and, in addition, it participates in experiments on new types of ecological fuel [Miklaszewski, 2002, 116]. Also, the Wrocław transport company DLA cares about ecology, using modern stock which runs on gas [Dobrosławski, 2004, 9–1].

Despite the ongoing modernization of public transport in Wrocław and constant attention given by the documents of the city authorities to promotion, development and making public transport more attractive, it is becoming less and less popular. In 2000 the frequency of journeys by public transport was 1.36 per inhabitant per day. This figure had fallen to 1.07 by 2004, and 0.91 by 2005. This means there has been a decrease in the number of journeys by 33% in just 5 years [*Rocznik Statystyczny...*, 2006, 309]! So the actions of the authorities have been almost completely ineffective! Private transport is winning with public transport in almost every respect. The previously cited *Studium uwarunkowań i kierunków...* [2006] clearly states that public transport in Wrocław is not able nowadays to compete with private motorization and this situation will not change in the short term. This is occurring because public transport does not fulfill the basic demands for transport from Wrocław's inhabitants. During rush hours, which due to the renovation of the

transport network last about half the day, the city is very congested. Also, the standards of cleanliness in public transport leave a lot to be desired, although this situation has improved dramatically during the last 10 years. In addition, public transport fares are relatively high, independently of the length of the journey. On many lines the frequency of journeys is low and this, together with worsening punctuality (mainly as a result of the large-scale renovation of the transport infrastructure and constant increase in the number of private cars), significantly affects the quality of the services offered by the city's transport companies. The organization of many intersections of lines is ineffective. The stops at these intersections are often too far apart and separated from each other by large-scale pedestrian crossings. Such a situation occurred at Plac Kromera before its renovation, the cross-road made up of Legnicka, Kwiska and Wejherowska Streets and many others. It is a positive sign that this problem has been noticed by the authorities of Wrocław. In the plans for the reconstruction of Plac Grunwaldzki the integration of tram and bus transport can be seen, with convenient access to all the bus stops. It is to be one of the biggest and most best laid out intersections of public transport lines in Wrocław.

Of course, public transport in Wrocław also has some good qualities. Many solutions have already been applied which give priority to public transport, *i.e.* separate lanes for buses, joint bus and tram stops separated from the roadway. In some places public transport has priority at traffic lights. Also, the exchange and modernization of the stock by MCT Ltd. should be noted. This has had a positive impact on travel comfort and decreased the external costs generated by public transport in the city. Table 1 presents a brief SWOT analysis of public transport in Wrocław.

Table 1. A SWOT analysis of public transport in Wrocław

Opportunities	Threats
<ul style="list-style-type: none"> - integrated system of transport management in the city, - systematic policy of modernizing the stock of trams, - the possibility of exploiting the existing rail network, - creating a basis for a system of traffic control in the city. 	<ul style="list-style-type: none"> - increasing demand for private transport, - problems with traffic flow in the city due to renovation work, - small capacity of communication chains, - lack of strong competition in the market for transport.

Source: *Zintegrowany Plan Rozwoju Transportu...*, 2006, 32-33.

In order to make the city's transport system sustainable, it is important to popularize bicycle and pedestrian traffic. Wrocław has 130 km of bicycle routes. However, they are characterized on the one hand by a low level of cohesion

and on the other hand they are often of low quality [*Studium uwarunkowań i kierunków...*, 2006, 140–141]. Although the length of these routes is constantly increasing (according to estimates, by about 20 km per year, mainly due to road investments), they are not extensive enough to create a coherent system attractive to the many inhabitants who could and would like to use this means of transport. The Programme of the Development of a System of Cycle Routes in Wrocław for 1996–1999 was passed in 1996. During this period about 80 km of bicycle routes were created. It is worth mentioning that the policy of constructing cycle routes in Wrocław is also being shaped with the active participation of the city's inhabitants through the cooperation of the city authorities with social organizations, especially with The Wrocław Coalition of Cyclists [Kaczyński, 2005]. This coalition is currently monitoring acts of law, decisions of the city authorities and what is even more important – the actual character of the routes from the point of view of their meeting the needs of cyclists [*Koalicja Rowerowy Wrocław*, <http://www.rowery.eko.org.pl>]. However, these actions are not sufficient in themselves. Although cycling is popular in Wrocław and the low-lying, flat terrain facilitates the construction of a network of cycle routes, still many years will have to pass until a satisfactory network has been developed. This is hampered by the previously mentioned incoherent network of bicycle routes, dangerous crossings, sections of pavements “held in common” with pedestrians etc. Some hope is given by *The Concept of a Basic Network of Bicycle Routes in Wrocław*, passed as Act of the President no. 5493/05 of June 9th, 2005 together with *Planning and Executive Standards for the Network of Cycle Routes in Wrocław*. Maybe this, together with *Study on the Conditions and Directions of Land Development in Wrocław*, will constitute the beginning of a long-term strategy for the development of bicycle transport, which is essential for every city. In the field of pedestrian traffic, the actions of the city authorities and planners are still concentrated on Zones I and II, which are in the city center, but no definite actions, apart from organizing pedestrian streets, have been taken.

5. Summary

To summarize this brief analysis of the public transport system in Wrocław, unfortunately it has to be concluded that it does not comply sufficiently with the principles of sustainable development. The inhabitants of Wrocław are still exposed to high external costs resulting from transport and private transport is winning the competition with public transport. Also, many projects, despite legal declarations by the city authorities, are completed late or bring smaller effects than planned. However, some initiatives can be appraised positively, e.g. the modernization of the bus stock by MTC Ltd.,

granting priority to public transport on some sections of road, modernization of tram lines, introducing a system of dynamic, electronic passenger information at bus stops and in vehicles, implementation of integrated electronic tickets in the whole of the public transport network. It may be supposed that in the near future, when many road investments for which the city received subsidies from the EU are finished, the situation in this area will improve significantly. Especially since in the Land Development Plan for Wrocław there are such solutions as water trams (this will make use of the potential inherent in the River Oder flowing through the city center, mainly for touristic purposes) or the planned Integrated System of Railway Transport in Wrocław and the surrounding area. This venture needs special attention as, in accordance with "the oldest" concepts of the construction of an attractive and competitive system of public transport, it includes a local system of railway transport (The Wrocław Agglomeration Railway, WAR), the system called Tramway Plus (in short T+) and also the current (classical) tram network. The Wrocław Agglomeration Railway is a mutual venture of the municipal and regional authorities and is to provide convenient railway connections for inhabitants of the whole province and the city itself. Relying mainly on the existing rail infrastructure (that, of course, requires modernization and other investments to adapt it to modern needs) and on bus transportation, which complements the railway service, this railway network gives an opportunity for the improvement of public transport and at the same time diminishes the negative impact of transport on the environment in the Wrocław region. The planned Tramway Plus system is an equally necessary element of the future transport system in Wrocław. This network would be separate from the classical tram network with a distinct image. It will have environmentally-sound, modern trams that will ensure a high level of comfort and access for disabled people. This system would have priority at traffic lights and an electronic information system for passengers. The Tramway Plus Network is to link the center with large housing estates and its infrastructure is to be integrated with the rail network (among other things it would use tracks to suburban stations).

The conclusion of at least part of the planned investments in Wrocław's transport system should result in the availability of comfortable, environmentally friendly public transport. Perhaps, the level of restrictions on car use will increase and the inhabitants of Wrocław will become more educated in the field of sustainable transport. Would this guarantee the sufficiently sustainable functioning of transport within the city? A reduction in the share of private motorization and an increase in the share of public transport is necessary. Also, above all – the awareness of Wrocław's inhabitants regarding sustainable transport and a more active role of the city authorities in developing such awareness are both crucial.

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