

Problems With Organising Agglomeration Passenger Transport Network – The Case of Warsaw Agglomeration

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The main achievement of the research was to present the problems of accessing public transport in Warsaw agglomeration. The case study of Sulejówek shows that there are a lot of difficulties with the regional transport network. On the one hand there are organisation issues as inefficient or lack of support of train transport and, on the other hand, bad quality of local roads. Nevertheless, the simulation presents that it is possible to organise bus lines which allow inhabitants the access to the local train stations.

The next step of the research would be creating timetables for both presented solutions in combination with train timetables and choosing the optimal option for implementation. This kind of research could be the recommendations for local authorities which are in charge of public transport issues. If both modes of transport are covered by one common ticket, the whole system would operate on effective and high level.

Keywords: public transport, city rail transport, agglomeration.

1. INTRODUCTION

Sustainable mobility concerning optimised transport network in the cities and their suburban areas is one of the priorities of the EU transport policy. The balance should be achieved by using different modes of transportation in order to offer the proper service for transport demand, and, what is also certain, with respect to reduction of congestion and harmful environmental effects. Apart from the problem of freight transport within the cities which seems to be solved by infrastructure planning (e.g. ring roads in cities, bypasses around cities) there is a huge advantage in organising the public transport for citizens. It has to be available without any exceptions for each group of citizens, and be based on pre-established routes, timetables, fleet and tariffs that are designed to meet users mobility requirements on urban territorial scale (Zatti, 2012). From the whole market point of view, local transport has features of a natural monopoly because the time and route slots are unique and there is a need to coordinate time plans and stops (Fiorio, et al., 2013). The aim of the paper is to investigate the problems with organization of public transport

network appearing in Warsaw suburban regions based on Sulejówek commune, and to present the proper solution for this area from the passengers point of view.

2. METHODOLOGY

Research in this paper includes: 1) the presentation of public transport system organization in Warsaw and its suburban areas, 2) the analysis of existing transport network including time tables in Sulejówek area, 3) proposal for optimising the network created in PTV Visum software which is commonly used for drafting public transport system. Collected data consists of primary and secondary data. For the primary data collection, the investigation of timetables and routes was composed. Time, frequency and synchronization were taken into consideration. There were also own observations used to characterise the problems of accessibility to public transport service. Secondary data are included in the literature review and low acts studies.

3. RESEARCH AREA

Warsaw agglomeration area is not clearly defined. Generally, it is acceptable to describe it as highly urbanized area which consists of Warsaw city with numerous towns and villages (fig. 1) of the central part of the Mazowieckie province (Domański, 2006).

such as: buses and regional trains (trams and underground lines are not available in any commune in agglomeration). In 2014 the municipality had 19,323 inhabitants, which gives a population density of more than 1,000 people per km². Approximately 30% of economically active population of this commune commute to Warsaw every day for professional purposes using private



Fig. 1. Warsaw agglomeration.

Throughout the area public transport is perceived as more and more attractive. The city reports state that in 2014 residents frequently used buses, trams were on second place, then the underground and rail. The number of daily journeys to work and back is estimated at more than 665 thousand (ztm.waw.pl, 2014). When public transport permanently develops, the elimination of weaknesses such as mirroring the rail transport and bus lines or over-complicated system line is the must-be affair.

The research region was Sulejówek - one of the communes belonging to Warsaw agglomeration area. It was chosen intentionally. The authors selected the region in direct neighbourhood of Warsaw city border with public transport modes

or public transport modes. The index of cars per 1,000 inhabitants is 551 (stat.gov.pl, 2014). This is more than Polish average and the average of the European Union. This can provide a high standard of living, however at the same time it can cause the increase of congestion inside the community.

4. ORGANISATION OF WARSAW AGGLOMERATION PUBLIC TRANSPORT SYSTEM

The public transport system in Polish regions is one of the main tasks of local governments (communes, cities etc.) based on "law on communes own-tasks". The way and possibility of its implementation depend on local needs,

particular municipality structure, its location, area and population. Issues related to the organization and financing of public transport are essential in context of suburban areas belonging to wider agglomeration in which every day hundreds of inhabitants must be provided with access to this service.

The regulations of Warsaw public transport are defined in the act "of public transport". According to its assumptions there are two actors involved in public transport organisation and these are: the organiser responsible for the management which is Zarząd Transportu Miejskiego (Eng. *Municipal Transport Management*) (ZTM) and the operators which offer the service (tab. 1). It seems to be extremely important that there is an institution (ZTM) which is in charge of many local operators. It makes sure the operations are in accordance with cities sustainable development programs, most of which aim at growing importance and need to promote public transport (Czarnecki, 2013).

Table 1. Daily number of kilometres offered by operators of public transport in Warsaw agglomeration (03.2014).

Public transport operators	Mon-Fri		Sat-Sun, public holidays	
	Daily lines	Night lines	Daily lines	Night lines
Warsaw Trams	163,956.059	-	100,460.523	-
MZA	243,473.300	10,518.656	155,311.181	10,700.743
Warsaw Underground	78,943.800	-		-
SKM	50,527.094	-	41,276.752	
Agencies	90,403.439	2,284.828	78,084.921	2,723.595
L Lines	8,728.012	-	3,976.245	-

Source: own elaboration based on um.warszawa.pl data

The authors of "the public transport" act underline that the core of Warsaw public transport system is rail transport (trains, underground, trams) with additional bus lines playing an essential role in the hallways unsupported by rail transport and allowing the access to interchange bus-rail points. ZTM is responsible for organising optimal passenger transport network in the agglomeration using available infrastructure and cooperating with the operators to achieve the assumptions from act of public transport.

5. SULEJÓWEK - WARSAW CITY CENTRE TRANSPORT NETWORK

The most important mode of transport which links Warsaw city centre and Sulejówek is railway. The region has two train stations: Sulejówek and Sulejówek Miłosna where two companies operate: Szybkie Koleje Miejskie (SKM) and Koleje Mazowieckie (KM). Travel by train to the station in Warsaw downtown which is located in the centre of the capital, takes about 32 minutes.

SKM trains run regularly with a frequency of 30 or 29 min, while KM trains are less regular. Nevertheless, the common timetable for both operators offers several trains within 60 min in the morning and afternoon peaks (tab. 2 and tab. 3-marked as grey). We assume that commune itself has good train connection with Warsaw downtown. The problem appears when the transport to these train stations is taken into consideration. MZA as the road transport operator offers 10 bus lines in the commune (No 173, 198, 315, 411, 502, 514,704, 720, 722, 730), however, none of them is connected with train stations Sulejówek or Sulejówek Miłosna and only three of them stop next to the train stations located in other communes. Each of these bus lines go to Warsaw. Apart from that, there are 4 private transport companies offering bus connection from the commune directly to Warsaw city centre („Jedność” Przewóz Osób Autobusem s.c., STANMAR, Mobilis Sp. z o.o., Gemini). Two of them offer several stops in the commune, though the buses run only every 60 min in peak hours. This makes bus transport operators strong competitors for trains connections rather than support. Train stations are than used mainly by citizens living nearby (fig. 2), who are able to walk to the station (10-15 minutes - app. 1km) or ride a bike (10 minutes - app. 2.5 km).

Table 2. SKM and KM departures timetable: Warsaw direction.

Hour	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Min	32	05	02	02	03	10	07	08	06	06	<u>28</u>	07	02	03	07	10	10	07	<u>28</u>	<u>27</u>
	<u>57</u>	<u>28</u>	<u>28</u>	09	12	<u>28</u>	<u>28</u>	<u>28</u>	<u>28</u>	<u>28</u>	33	<u>28</u>	<u>28</u>	<u>28</u>	28	25	<u>28</u>	<u>28</u>	34	59
		33	29	<u>28</u>	<u>28</u>	33	33	33	37	34	<u>57</u>	33	33	35	36	<u>28</u>	33	33	<u>57</u>	
		39	35	33	35	<u>57</u>	<u>57</u>	<u>57</u>	<u>57</u>	<u>57</u>		<u>57</u>	<u>57</u>	<u>57</u>	44	<u>57</u>	<u>57</u>	<u>57</u>		
		<u>57</u>	<u>57</u>	38	<u>57</u>										<u>57</u>					

00 - SKM operator, 00 - KM operator

Table 3. SKM and KM arrivals from Warsaw.

Hour	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Min	00	56	<u>51</u>	01	01	01	10	01	01	01	<u>22</u>	01	01	01	00	01	02	01	00	<u>22</u>	01	01
				<u>22</u>	<u>22</u>	19	17	<u>22</u>	21	<u>22</u>	22	<u>22</u>	<u>22</u>	<u>22</u>	<u>22</u>	<u>22</u>	<u>22</u>	11	<u>22</u>	<u>51</u>	<u>22</u>	<u>19</u>
				22	37	<u>22</u>	<u>23</u>	36	<u>23</u>	42	<u>51</u>	33	22	26	22	23	26	<u>22</u>	25		<u>51</u>	42
				<u>51</u>	42	<u>51</u>	<u>52</u>	<u>51</u>	<u>51</u>	<u>51</u>		<u>52</u>	<u>51</u>	45	46	46	45	<u>52</u>	33			
					<u>51</u>					57					<u>52</u>	<u>52</u>	<u>52</u>	<u>52</u>	<u>51</u>	56		

00 - SKM operator, 00 - KM operator

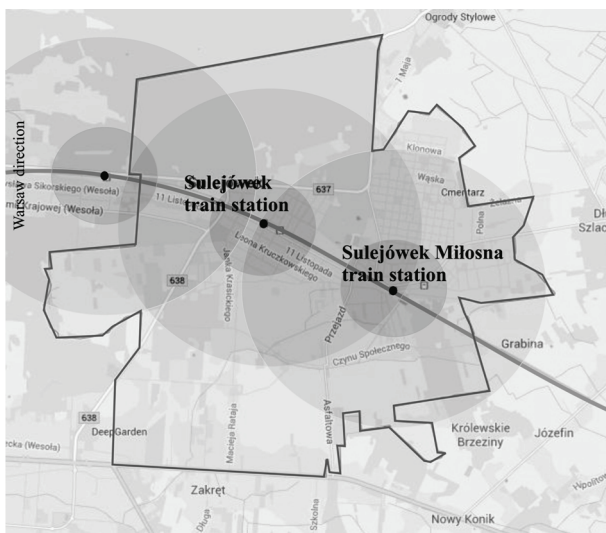


Fig. 2. Accessibility of Sulejówek and Sulejówek Miłosna train station.

6. UPGRADE THE TRAIN STATION ACCESS FOR INHABITANTS OF SULEJÓWEK COMMUNE

Considering trains connections, bus lines and commune infrastructure (bus stops, train stations, roads net) the conclusion appears that upgrading transport net, planning of the passenger bus transport in Sulejówek is highly recommended. The following section will present two possible solutions for this particular problem (S1 and S2).

Each route includes paved roads that allow larger vehicles to navigate through them. The ends of the bus lines require adaptation of the surrounding infrastructure.

In S1 two bus lines (A1 and A2) are created. Each would operate on one side of the commune: from the north and south side of the rail trucks (fig.3). Both lines are organized in the loop where buses run in two directions and pass near two railway stations.



Fig.3. Bus lines A1 and A2 in solution 1.

The second solution (S2) implements the bus lines B1 and B2 which support transport system from eastern and western part of the commune. These lines pass through the crossings and stop nearby train stations (fig.4). In this case line has two ends.



Fig. 4. Bus lines B1 and B2 in solution 2.

7. SUMMARY

The main achievement of the research was to present the problems of accessing public transport in Warsaw agglomeration. The case study of Sulejówek presents that there are a lot of difficulties with the regional transport network. On the one hand there are organisation issues such as inefficient or missing support of train transport and, on the other hand, poor quality of local roads. Nevertheless, the simulation presents that it is possible to organise bus lines which allow inhabitants the access to the local train stations.

The next step of the research would be creating timetables for both presented solutions in combination with train timetables and choosing the optimal option for implementation. This kind of research could be recommendations for local authorities which are in charge of public transport issues. If both modes of transport are covered by one common ticket, the whole system would operate on effective and high level.

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