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Integration of main bus and railway stations in voivodship cities in Poland

Abstract: Availability of rail transport is limited, due to lack of infrastructure or unprofitable. Therefore the linkage between rail and bus network are the basis of an efficient public transport system. From a passenger's perspective, the most important role plays spatial integration (in the context of transfer). The aim of the article is to evaluate the integration of the main railway and bus stations. The study is based on the voivodship cities, which are the most important transport nodes in this country. Author focus on the location of stations in the city space, their distance, but also the spatial barriers that may hinder a possible transfer.

Keywords: Railway Station; Bus Station; Transport Node

Introduction

According to the time-price model of Żurkowski, efficient railway transport is the most competitive means of transport for inter-metropolitan displacements up to 600 km [17] [9]. Usually, it is a skeleton of a transport system in a given country, which is supplemented by bus transport.

In Poland, thanks to infrastructure investments in recent years [21], the times of train travel on most routes between the largest cities have been significantly shortened, and as a result translated into a systematic increase in the number of passengers [22]. At the same time, in the majority of provinces, the regression of regional railways is observed, as evidenced by the limitation of the number of connections or the total suspension of passenger traffic on the given lines. According to Bocheński's research, there are nearly 100 cities in Poland (25% of the total), which is inhabited by a total of about 2 million people, in which there is no passenger rail traffic [1]. In the situation of limited accessibility of the railway, bus transport should play a complementary role. Therefore, it is extremely important to integrate these two systems, which is based on the joint location of railway and bus stations, in order to enable efficient interchange. The provincial cities, which are the main traffic generators, play a special role in this system. They should be interchanges with extensive service facilities [13], and the primary function of these facilities should be the integration between different modes of transport [16].

The purpose of the following article is to assess the spatial integration of major railway and bus stations in Polish voivodship cities. In the study, the author focused on the assessment of their location in the city space, mutual distance, and also pointed to spatial barriers that may hinder a possible change.

Integration of means of transport

The integration of transport means is set as one of the basic transport objectives in the European Union, and thus in individual member states [11] [15]. Many references to integration issues can be found in studies on shaping transport policy [2] or those referring to improving accessibility [12]. Chiena and Schonfeld's research focused on the relationship

between rail and bus transport in the context of the so-called feeder buses, for which the destination is not the city center and the interchange node on the outskirts, which ensures the most efficient use of rolling stock [4]. In the model assumption, bus transport should complement rail transport, and its lines should have a course perpendicular to the railway line, and not duplicate the train route.

On Polish soil, the integration of railways with other modes of transport was the subject of interest for A. Ciechański [3], who attempted a comparative analysis of the experiences of Poland and neighboring countries in this area. In turn, M. Kruszyna presented the model of integration of passenger transport with the appropriate hierarchy of stations and the principles of cooperation of these means of transport [14]. The possibility of transferring from rail to bus transport was one of the components of the comparative analysis of the potential of railway stations in the suburban zones of Kraków, Łódź, Poznań, and Wrocław as integrated transfer nodes [10]. Although this topic appeared in the literature, in none of the above studies the spatial aspect was the main field of interest, hence the following study may be complementary to the current knowledge.

Research methodology

The introduction to the research was the identification of the main railway and bus stations in individual cities (table 1). In the case of a railway station, the selection was made on the basis of the number of inter-refrigerated (qualified) trains serviced by PKP Intercity. The regional and agglomeration traffic was deliberately omitted because the majority of transfers in the main city of the voivodship are supposed to concern long-distance trains. In addition, in some cases a high number of short-distance connections could distort the results, which could lead to incorrect identification of the main station in a given city. In the case of the situation where the system of the railway network in the city caused that several stations performed the same number of long-distance connections, an additional selection criterion was used based on the name. Then the station that had the "main" name in the name was selected or the name of the station was identical to the name of the city, which also testified to the rank of the object. The exception was made for Warsaw, where the main station is Warszawa Centralna, which is distant from the largest bus station Warszawa Zachodnia, but the layout of the railway network means that all long-distance trains pass through the so-called. a mid-range line connecting eastern and western Warsaw, therefore it would be unnatural to study the distance to the bus station from a different station than Warszawa Zachodnia, because it gives you full interchange possibilities.

In the case of bus transport, the number of carriers serving the given facility was used as the criterion for selecting the main station. When analyzing the number of connections, there would be a risk of too high position of railway stations from which suburban trains with a very large number of trips during the day depart, which would overstate the result, and not necessarily testify to the rank of the station. In addition, in the case of bus transport it would be much more difficult to define which connections can be considered long-distance.

Tab. 1. Main railway and bus stations in provincial cities in Poland

city	railway station	bus Station
Białystok	Białystok	Ul. Bohaterów Monte Cassino
Bydgoszcz	Bydgoszcz Główna	Ul. Jagiellońska
Gdańsk	Gdańsk Główny	Ul. 3 Maja
Gorzów Wielkopolski	Gorzów Wielkopolski	Ul. Dworcowa
Katowice	Katowice	Ul. Skargi
Kielce	Kielce	Ul. Czarnowska
Kraków	Kraków Główny	Ul. Bosacka
Lublin	Lublin	Al. Tysiąclecia
Łódź	Łódź Widzew	Al. Włókniarzy
Olsztyn	Olsztyn Główny	Pl. Konstytucji 3 Maja
Opole	Opole Główne	Ul. Krakowska
Poznań	Poznań Główny	Ul. Matyi
Rzeszów	Rzeszów Główny	Ul. Grottgera
Szczecin	Szczecin Główny	Pl. Grodnicki
Toruń	Toruń Główny	Ul. Dąbrowskiego
Warszawa	Warszawa Zachodnia*	Al. Jerozolimskie
Wrocław	Wrocław Główny	Ul. Joannitów (tymczasowy)
Zielona Góra	Zielona Góra	Ul. Dworcowa

*- all trains in Warsaw pass through the so-called the East Warsaw - West Warsaw mid-range line, which made the station most integrated with the bus station.

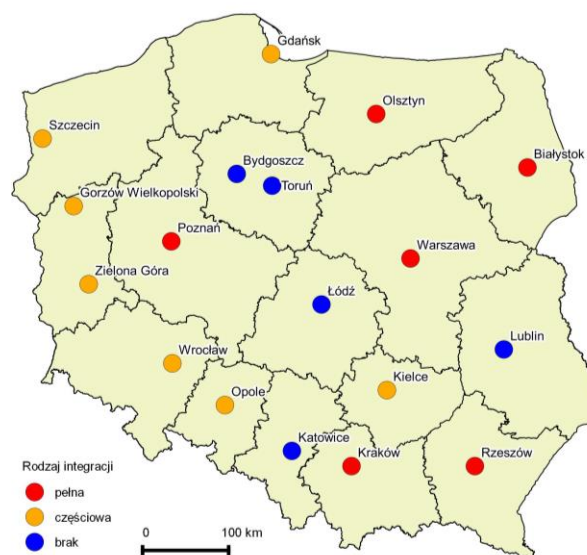
Source: Own study

After the selection of the main stations in the city area, the second stage, ie the degree of spatial integration, was initiated. In the course of the work, three types of spatial integration of stations were used, the meaning of which should be explained. Full integration meant that the railway and bus stations constitute one complex of buildings, connected with each other, without any spatial barriers such as roadways or other buildings. In other words, moving from the railway platform to bus stations we still move within one station facility. Term - partial integration was used to identify objects located in the neighborhood, but with some barriers such as roadways, intersections, underpasses, other buildings. The neighborhood was determined to assume an acceptable distance of up to 200 meters in a straight line from the center of the platform nearest to the railway building to the edge of the first bus station. If this distance exceeded 200 meters, then it was assumed that there is no integration between the two objects (third type).

Findings

The survey showed that the number of voivodship cities in Poland with certain types of integration of railway and bus stations was similar (Figure 1). The type of integration was not dependent on the location or size of the city, because in each group there were cities with a diverse population, as well as a different location. Full integration was noted in six cases, but as a subgroup, the case of Kraków and Poznań can be distinguished, where the integration of railway stations took place using the shopping center building. Both stations have been modernized as part of preparations for Euro 2012 [8]. In Krakow, the "Galeria Krakowska" was created with a designated part developed for the needs of rail transport and functioning

next to the bus station. In the case of Poznań, both the railway and bus stations were included in the area of one "Avenida" building (formerly "Poznań City Center") (Fig. 2). In both cases, the functionality of this type of solution should be discussed. Although the services are a natural complement to the transport function, what's more is their development within the nodes, however, when using these two objects you may wonder if the services complement the transport or transport is an addition to the shopping center. In the case of Poznań, firstly, the railway stations are separated by concrete barriers (Figure 3) and the only passage between the railway platforms and bus stations leads through the shopping center which causes significant difficulties at the start. In addition, on this route, you have to use the narrow, movable stairs within the gallery with high traffic volume, which additionally lengthens and makes it difficult to make an efficient change. A lot of information is also left to the information coat of the object, where there are often no plates with the direction of the bus station or they are not very legible, you can get the impression that it is easier to find the right store brand than going to the station.



1. Type of railway station integration with a bus station in provincial cities in Poland in 2017. Source: Own photography



2. Integration of the railway station with the bus station within the "Avenida" shopping center in Poznań. Source: Own photography



3. Separation of the bus station from the railway station in Poznań. Source: Own photography

Cracow seems to be a little more functional, where the mall's object itself does not separate the two stations, but there are several elements that can be discussed in the context of functionality. For example, a passenger getting off at the first level of the Krakow bus station intuitively goes to the railway platforms, which he sees behind the glass wall (Figure 4). In the end, it turns out that there is no such transition, what is more, there is also a lack of clear information about the need to move to the lower level of the bus station, which is integrated with the railway station. Another element is the exit to the city from the railway station through the "Galeria Krakowska", which takes far too much time, and is also not very intuitive and requires a lot of perceptiveness and continuous control of the navigating characters. Although it is possible to leave the objects directly, almost directly from the railway platforms, the main signs lead to the gallery building and the traveler who does not know the object will probably choose this option.

The tendency to build stations as part of a shopping center also appears in other cities, for example Wrocław. According to plans, the shopping center "Wroclavia" will be put into use in the place of the former bus station at Sucha Street. The facility will have 64,000 sq m of retail and service space (including 200 retail and service outlets), 7,000 sq m of office space and only (with such a large scale of investment) 11 bus stations at the lowest level, which seem to be a sure addition to the service zone [18]. In addition, there is a fear that the station will accommodate all carriers and will not come to a paradoxical situation that despite the existence of the main station in Wrocław, buses will still leave from several different places (in addition to the gallery "Wroclavia" it would be the so-called Temporary Station at Joannitów Street and a stop on the David Street).



4. Separation of the second level of the Małopolska Bus Station in Krakow from the Kraków Główny railway station. Source: Own photography

In the case of partial integration, which was noted in 7 cities, the spatial barriers separating the railway station from the bus station should be analyzed. These barriers are always an element that hinders change, especially for people with luggage and those with limited mobility. The first barrier may be the lack of clear information (signs) in which direction you should go to the station of the second mode of transport, because it is often not intuitively perceptible. According to the author, this element could be improved in each city. In all cases, a certain barrier to overcome is crossing the road, because everywhere the road separates two objects. In most of the cities in this group it is a level crossing without traffic lights. It seems that the lack of signaling is a good solution because they are not roads with very heavy traffic and these transitions are safe. The signaling was used only in the case of Kielce, where both stations are separated by one of the main communication arteries of the city (provincial road 762) and pedestrian traffic control signaling seems to be indispensable. In Gdańsk, an underground passage has been used as the only city, which allows for collision-free movement, but it seems that this type of solution is only an additional barrier. According to the author, in the case of partial integration of railway stations, the best solution is pedestrian crossing in the road level, without traffic lights in the case of low traffic, while at higher intensity with traffic lights with a relatively short waiting time for pedestrians.

The last group consists of cities where there was no integration between railway and bus stations, which is a serious barrier to the potential construction of transfer nodes. The distances between the stations and the possibilities of displacement using public transport along this route are presented below (Table 2). The distance from two objects was given in both a straight line and a pedestrian route based on the calculations of Google Maps [20]. In the case of public transport, the number of lines servicing the given section and travel times was determined according to the directions of the jakdojade.pl portal, taking into account only direct connections and excluding substitute communication.

Table 2. Distance from the railway station to the bus station and the offer of public transport on this route in voivodship cities, in which these facilities are not integrated 25/07/2017

city	distance between stations		number of public transport lines serving the route	public transport travel time		
	in a straight line [km]	on foot [km]		minimum [min]	maximum [min]	average [min]
Bydgoszcz	2,2	2,7	2	10	10	10
Katowice	0,5	0,6	3	5	7	5
Lublin	2,3	2,6	2	12	25	18
Łódź	7,7	8,6	2	25	25	25
Toruń	1,5	2,8	5	4	8	5

Source: Own study based on data <https://jakdojade.pl>

The smallest distance was noted in the case of Katowice, where on the one hand it can be an asset with the other obstacle. Although it is only 550 meters on foot, hence most indications of jakdojade.pl portal [19] gave this type of displacement as the best opportunity on the route. On the other hand, the distance of over 0.5 km with luggage for some travelers may seem uncomfortable. Although public transport gives many possibilities of travel between objects, the nearest "Sokolska" stop is located 120 m away from the station in a straight line and is also in the opposite direction, which cannot be found by travelers intuitively heading in another direction.

The largest distance between the stations was noted in Łódź, it is as much as 8.6 km on foot, and the displacement using public transport takes an average of 25 minutes. It is true that the Łódź Kaliska station is located next to the bus station, which would allow for full integration, but in recent times the role of this station has decreased. In Łódź, the problem of the location of a typical central station is evident. Currently, long-distance connections are divided between two stations: Łódź Widzew and Łódź Fabryczna. A few trains pass through the Łódź Kaliska station, however, the connection is also served by the Łódź Widzew station, while the reverse dependence does not occur. It would seem that the chance to create a central station in Łódź was the opening of a new Łódź Fabryczna station, however, due to the fact that it is a headend, it currently does not support through flights. The potential could be all the greater since 10 bus carriers offering domestic and international connections, including: Polskibus and Leoexpress, leave from the vicinity of Łódź Fabryczna station. In the era of striving for the shortest possible travel time, a situation where all long-distance trains would be serviced by the Łódź Fabryczna station should be questioned, exposing themselves to losses related to the change of direction.

As in Łódź, the distance between the railway and bus stations in Lublin is a serious difficulty, where the average travel time of public transport is almost 20 minutes. However, there is a real chance to change this situation, because the plans are to build an Integrated Intermodal Metropolitan Railway Station as part of Integrated Territorial Investments [23]. Studies show that the investment has a very high potential and will probably contribute to

better service for residents and increase of availability which can certainly be a positive impulse for the development of the whole of Lublin [6].

Summary

In Polish voivodship cities, various types of integration between railway and bus stations can be observed, some of them are located within one complex, some next to each other, while others operate in isolation. The share of particular types of integration was fairly even, and the location of the city, its size or function did not affect the results. As part of full integration, it is worth highlighting a new model in which the railway and bus stations are connected within the shopping center building. This type of solution was used in the case of Poznań, where the transition between the stations takes place through the gallery and Krakow, where the gallery does not separate the stations, but creates one large complex with them. In both cases, the discussion should include the functionality of this type of solutions, where the trading zone becomes a dominant element and even hinders the efficient use of the communication zone. Nevertheless, the biggest problem and barrier to the development of integrated nodes occurs in the case of isolation of stations in the city space. Although there is public transport in each of the cities on the route between the facilities, in the case of Lublin and Łódź, travel times can be a significant obstacle for the traveler.

On the basis of research results and comparison of the experiences of various cities in the field of integration, several conclusions and recommendations can be formulated. First of all, we should strive to locate bus stations next to the railway station and create integrated transfer nodes there. As results from research in many centers around the railway station are the most accessible places in the city, which are usually the center of its communication system [7] [5]. Secondly, we should strive for full and comfortable integration, ideally within one complex, when it is impossible to take care of an appropriate information structure that facilitates navigation and avoidance of spatial barriers. A commercial and service base should be located within the railway station, creating next to the railway and bus area a so-called pedestrian zone [14]. However, it should be remembered that these facilities are to complement the transport function, and the facilities must be primarily functional and adapted to transport needs. According to the author, the combination of the station and shopping gallery in Krakow and Poznan disrupted the transport function of the object, the layout of passages was created for marketing, becoming a factor hindering the efficient use of stations and possible quick change.

A positive impulse may be the implementation of the project of a new station in Lublin, which is expected to function as an Integrated Intermodal Metropolitan Railway Station. Perhaps a chance for Łódź is the further development of Łódź Fabryczna station, where the bus carriers are gradually starting to move. The only question is whether Łódź Fabryczna, with its leading layout, has real possibilities to become the main station in Łódź and to perform all long-distance trains (including those that pass through).

Source materials

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