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**The analysis of the rail accessibility to the health resorts in the Dolnośląskie and Małopolskie voivodships**

**Abstract:** The article concerns railway access to spas of two voivodeships in the southern part of Poland. The author conducted surveys in spas to identify traits that in the eyes of the patients are developmental factors of the railway. The content of railway timetables in terms of travel time to spas and frequency of connections was also analyzed. The idea of an original typology of health resorts is being developed in terms of accessibility by rail. Four types of spas were distinguished: neighborly communication, poor reachability, unused opportunity and tourist expansion.

**Keywords:** Railway transport; Transport accessibility; Health resort

Transport accessibility is an incredibly important component of tourist attractiveness, alongside tourist development and other assets. Its benefits include the tourists' possibility of reaching the tourist space, exploring it and moving between accommodation, food facilities and tourist attractions. Apart from individual road transport a very important aspect in the matter of public transportation accessibility is the number of connections, travel time and its competitiveness with other means of transport and the quality of transport which consists of many different factors - vehicle comfort, amenities, standard of services on board, etc. Rail transport aspires to take up a competitive battle for the client - passenger, competing with other means of transport (cars, planes, ships). This competition is manifested in the appropriate pricing policy, investment activities (revitalization, repairs) which could shorten the travel time, introducing a new and improved rolling stock offering more possibilities and paying attention to the needs of potential passengers. The author intends to analyze the state of transport accessibility to the health resorts of the Dolnośląskie and Małopolskie voivodships as the two regions with the largest number cities with a health resort status.

In order to conduct an accessibility analysis, it is necessary to determine its basic parameters - methodological assumptions, its scope and level of detail. By undertaking the analysis, the author wants to rely on the method of researching documents (train timetables) to determine the travel time and frequency of connections, which will then be presented on maps using cartographic methods. The use of cartographic methods is in this case, according to the author, necessary to graphically describe the travel time and make a comparison in a given area. Moreover, the results presented in this article are a part of a broader scientific research which the author had carried out to determine the role of rail transport in the patients' access to health resorts. A significant part of this research was an analysis of the results derived from collected questionnaires, which were carried out in July and August 2017 in six health resorts (in Kudowa Zdrój, Polanica Zdrój, Cieplice Śląskie Zdrój, Krynica, Ustka and Kołobrzeg). Six hundred and nineteen (619) filled forms were collected containing the patients' responses regarding their attitude towards rail transport, preferences in this aspect, the image of the railways and how useful this mean of transport was in the process of accessing the spa.

The train timetable could be treated as a base document for the purpose of scientific analysis. Although its immanent feature is variability, it only happens in certain cycles. The

Rail Transport Act indicates an annual change [9] but allows corrections during the year. During the 2015/2016 timetable, the following correction dates were established: 13 III, 12 VI, 4 IX, 16 October, which divided the year into 5 periods of the timetable certainty. Therefore analyzing the timetable during the year is a difficult task, due to its frequent corrections and new periods of validity, high rotation change in the number of connections and variability of train relations. Studies carried out at different time periods even within the same year could provide different results, making it difficult to compare and draw the right conclusions. The issue of the tourist season concerns increased traffic during the summer and winter months. The author of this work decided to study the timetable in the same time period for all spa resorts. Such a solution facilitates comparability of transport accessibility of all examined spas. The period chosen and accepted for testing, was the time from March 13 to June 11, 2016. The choice of this period was dictated by the expected increase in tourist traffic after the autumn-winter period. In addition, the study of the train timetable in the months of the second quarter of the year allows to capture tourist traffic which hypothetically could be more spa-like - since in the summer months a significant number of traffic is attributed to families and leisure purposes.

The timetable analysis carried out in this research was targeted at familiarizing the author with the number of trains per day connecting large urban centers with spas. A large proportion of tourists visiting spas come from big urban centers, that includes patients coming for health related purposes. There are many reasons for this: a significant part of the Polish population lives in cities (urbanization rate in Poland is above 60%), in large cities (e.g. over 200-500 thousand inhabitants) there is a better access to health care but there are also more cases of civilization diseases and thus health repair needs are more complex. Social awareness is not without its significance, which is naturally more developed in big cities, people decide to go on sanatorium trips more than in the countryside. In addition, large cities can be treated as interchanging points, e.g. tourists or patients coming to Kudowa Zdrój usually first reach the capital of the region - Wrocław, from where they go to their destination within the voivodship. Large cities (e.g. capital cities of provinces) can be in most cases treated as regional points focusing the domestic tourist traffic (and even foreign), from which it is easier to reach the spa town. This does not only occur in the aspect of rail transport, but in others as well. After the creation of separate regional rail carriers in many parts of the voivodships, the distinct character of the voivodship's capital as a transport hub is even further emphasized. Many carriers were established, their range of operation in most cases limited to one voivodship or to the nearest towns just outside the given voivodship. Said cities often have interchange properties. Examples of such rail carriers are, for example, Koleje Dolnośląskie, Koleje Mazowieckie, Koleje Małopolskie.

Quantitative analysis fosters formulating conclusions regarding transport accessibility. The number of connections is a certain answer to social demand and often a kind of compromise between the needs of the community inhabiting the area along a given railway line and the possibilities, e.g. technical possibilities, rolling stock, organization of traffic on the line and finally, economic. The number of transport connections per day and their duration can provide a lot of indirect information about groups of visitors. For example, frequent morning connections (e.g. from 4 to 8 a.m.) and afternoon connections (e.g. from 2 to 6 p.m.), carried out on business days from Monday to Friday, inform of a large number of passengers traveling to and from work or school (in highly urbanized areas). In the case of night connections (including sleeping wagons) available during the winter or summer holidays, their tourist nature can be determined with high probability. An even distribution of the number of connections per day may indicate travellers' constant interest in the region, but also how skilfully the transport policy of the authorities, wishing to ensure flexible access to the area, is being conducted.

In order to capture and present the travel time in a graphic way the cartographic isochron method was used herein. This method is often used by the author of this article to illustrate the relationship between transport and tourism and to depict them in cartographic terms (among others in: "Analiza dostępności kolejowej do największych miejscowości turystycznych w polskich górach", *Przegląd Komunikacyjny* nr 6 (June 2014), pages 25-28 [1]; "Autobusowa i kolejowa oferta w relacjach Szczecin – Wybrzeże Bałtyku", *Przegląd Komunikacyjny* nr 3 (March 2009), pages 27-32 [2]; "Ekwidystanty czasowe dostępności komunikacyjnej do wybranych miejscowości nadbałtyckich Pobrzeża Koszalińskiego", *Transport i Komunikacja* nr 6 (November – December 2007), pages 12-17 [3] "Nałęczowska Kolej Dojazdowa i jej rola w kształtowaniu przestrzeni turystycznej", *Przegląd Komunikacyjny* nr 10 (October 2006), pages 32 -35 [4] The method consists of determining lines showing equal time accessibility relative to the reference point [6]. The reference point is the capital of the voivodship, in which there are active railway lines transporting passengers to statutory health resorts. Since all the statutory health resorts in southern Poland with an active railway line nearby are examined, it is necessary to make several maps - separate for each voivodship. Due to the diversity of types of passenger trains (passenger - stopping at all stations and stops, and long-distance - not stopping at all stations) - it is necessary to include such diversity on the availability map. In the case of various long-distance trains traveling at different speeds on a given line to the spa (e.g. fast trains of the TLK type, InterCity trains, Premium express trains with Pendolino units, etc.) - the fastest connection between the capital of the voivodship and the spa was chosen. In some cases, fast trains (e.g. Pendolino) may not stop at the station of a given spa, which is why the fastest long-distance passenger connection which allows tourists to get off at the spa's station was chosen. The isochrones were marked on the map based on that speed of connection data. In the case of passenger connections - travel times will be slightly longer, which is due to the fact that you stop at each station and passenger stop. Therefore, isochrones will take into account the slowest connection between the capital of the voivodship and the spa. This will allow you to capture the differences between passenger train travel time and the fastest long-distance train. Such conclusions can be used, for example, to analyse the competitiveness of passenger train connections in relation to other forms of transport. In addition, the lack of lines in the color assigned to the fastest connections may indicate the existence of only passenger trains on a given line.

The method of analyzing documentation, which is the timetable (to examine the number of connections) and the cartographic isochron method (to examine the travel time) were carried out in a way that made it repeatable. In other words, a person who performs similar tests on similar material (spas) and the same timetable (same period of operation) should receive the same test results.

Another issue that is important for the research is research material. These are statutory health resorts operating on the territory of the Republic of Poland. In order to clearly determine which spas will be examined, it is necessary to read the list of statutory spas published by governmental bodies (Ministry of Health), and then to determine which cities are reached by the railway lines, which of them are active and which in the 2015/2016 timetable (in particular in the part of the timetable functioning from March 13 to June 11, 2016) maintain passenger connections.

The spa is an area where the spa treatment is carried out (e.g. based on medicinal resources located on its territory) [8]. Such area is given the status of a health resort based on the application submitted by the commune and the development of a so-called spa survey which states that you meet the requirements. In turn, the requirements include among others: having a medicinal climate and deposits of medicinal raw materials, having medicinal facilities, hospitals and sanatoriums providing spa treatment services. The legislator also emphasizes the supra-local importance of the town applying for the status of a spa.

In Poland, currently 45 cities are included as the statutory health resorts [11]. Not all of them have access to railways. In the Dolnośląskie Voivodship, rail access to: Cieplice Śląskie, Jedlina, Polanica, Duszniki, Kudowa and Długopole was analyzed. The railway lines to Świeradów, Przerzeczyn and Łądek do not have passenger connections and the railway does not reach Czerniawa and Szczawna Zdrój. In the Małopolskie voivodship, an analysis of the rail accessibility to Swoszowice-Kraków, Rabka, Piwniczna, Żegiestów, Muszyna and Krynica was carried out, while in the case of Szczawnica, Wysowa and Wapienne no analysis was carried out due to the lack of railway lines.

Dolnośląskie Voivodship is an area rich in both health resorts (11 towns, which is nearly 25% of the number of Polish statutory health resorts), as well as railways. The density of the railway network is one of the highest in the country (approx. 8.8 km per 100 km<sup>2</sup>, with an average of approx. 6.2 km per 100 km<sup>2</sup> for the whole country) [7], which is caused by historical events. The area of the voivodeship once belonged to the Prussian partition, in which the development of the railway network was quite smooth.

There is no direct connection between Wrocław and **Jedlin Zdrój** in the timetable for the researched period (March 13 - June 11, 2016). The official search engine - the first one displayed on the Internet after entering the phrase "train timetable" [10], recommends changing trains in Wałbrzych or Kłodzko. Due to the location of Jedlina in the immediate vicinity of Wałbrzych (about 5-6 km from the Wałbrzych Główny railway station), the author adopted Wałbrzych as a more convenient transfer point. The proposed changing in Kłodzko significantly extend the journey (about 2 hours through Wałbrzych and about 3 hours through Kłodzko). For the date of 30th March (Wednesday) selected from within the examined period of the timetable's validity - the website [www.rozklad-pkp.pl](http://www.rozklad-pkp.pl) proposed 9 possible routes from Wrocław Główny to Jedlina Zdrój. Most connections were made by trains belonging to the Koleje Dolnośląskie company. The earliest connection is possible by train consisting of traction units at 7:15 from Wrocław to Wałbrzych Główny (arrival at 8:41), from where a bus goes to Jedlina Zdrój after 14 minutes (at 8:55, arrival at 9:07). In both cases, these are passenger connections (served by trains stopping at each station and each passenger stop). The quoted morning connection is one of the shortest (the total travel time from the capital of the voivodship is 1 hour and 52 minutes) – however the shortest is one of the midday connection which takes 1 hour and 43 minutes (at 11:45 from Wrocław at 13 : 28 in Jedlina Zdr.). In only 3 cases the search engine recommends using a carrier other than Koleje Dolnośląskie, but only in the first stage of the journey from Wrocław (at 8:30, 15:46 and 22:55) – the other carrier is Przewozy Regionalne. Departure times from Wrocław Główny on the selected day are as follows: 7:15, 8:30, 11:45, 13:07, 14:59, 15:46, 18:03, 22:55 and 23:06. The analysis of departure hours shows that a relatively large accumulation of trains is concentrated in the morning (between 7am and 9am) and in the afternoon (between 1pm and 4pm). There is only one connection between these peaks (at 11:45). What is interesting, all these daily connections allow you to cover the route in up to 3.5 hours, while 2 evening connections are much longer and take from 6 hours and 49 minutes (in the case of a train at 22:55) to up to 7 hours and 10 minutes (23:06 from Wrocław Główny). It is caused by the arrival of trains from Wrocław to Wałbrzych or Kłodzko around midnight, without the possibility of further travel and the need to wait for the first early morning connection to Jedlina Zdrój. After entering the same query for April 3rd (Sunday), the site also showed 9 connections per day (the only difference was the connection instead of at 11:45, slightly earlier from Wrocław - at 10:55).

Summarizing, the connections between the capital of the voivodship and Jedlin Zdrój are not executed directly (there is a need for 1 change), they are only carried out by passenger trains (in most cases provided by Koleje Dolnośląskie, with the exception of Przewozy Regionalne's trains), there are 9 connections a day on a business day. The route takes from

about 83 minutes to 200 minutes (142 minutes on average), not including the connections with the night waiting for the first morning train to Jedlina after a change in Kłodzko or Wałbrzych.

**Cieplice Śląskie Zdrój** is a health resort located within the administrative borders of Jelenia Góra, however a little further than the main railway station. With 13 connections between the capital of the region and Jelenia Góra (12 direct connections and 1 with a change in Węgliniec) running on March 30th (business day), there are only 7 direct connections between Wrocław and the spa district of Jelenia Góra (via the Jelenia Góra Cieplice station). As many as 6 of them are served by Koleje Dolnośląskie, one connection was provided by Przewozy Regionalne. All of these connections are passenger trains, no long-distance connections (not stopping at all stations, and thus going faster). Train departure times from Wrocław are as follows: 4:47, 7:15, 9:43, 10:55, 12:50, 14:59, 16:50. As you can see, an approximately 2-hour departure cycle has been implemented here. Surprisingly there are no direct connections after 16:50 - until the next day. Because the connections are direct, there is no need to go through differently scheduled transfer periods, which results in a relatively similar journey time ranging from 2 hours and 29 minutes for the shortest train connection at 9:43 to 2 hours 51 minutes for the morning connection at 4:47. The average journey time therefore oscillates at around 160 minutes. The touristic nature of the line may be emphasized by the launch of an additional connection on weekends - on Sunday, April 3, there are not 7 but 8 connections on this route. The difference applies to the morning hours when the following trains depart from Wrocław Główny: at 5:48 (long-distance train), at 6:18, 7:15 and 9:24 (passenger trains). The long-distance train provided by the PKP Intercity category TLK carrier called Aurora runs between Wrocław Główny and Szklarska Poręba and travels to Cieplice (to the Jelenia Góra Cieplice station) in a time similar to passenger trains (2 hours 35 minutes or 155 minutes), which results from a long (18-minute) stop at the Jelenia Góra station.

Due to their location on the same line, access to **Polanica Zdrój**, **Dusznik Zdrój** and **Kudowa Zdrój** will be analyzed together. To get to these spas on a business day (one randomly selected in a middle of the week during the period of the research period) the search engine suggests the possibility of using 6 connections a day from Wrocław (30th March 2016). Trains depart from the capital of Dolny Śląsk at 5:35, 6:34, 8:30, 13:07, 15:46 and 17:58. Only the midday connection is direct (the Koleje Dolnośląskie's train leaving at 13:07), the other connections include 1 change in Kłodzko allowing the use of the Przewozy Regionalne's train (to Kłodzko) and the Koleje Dolnośląskie (to health resorts). Trains reach Polanica Zdrój at 8:00, 9:27, 12:36, 15:02, 18:20 and 20:07 respectively. The longest connection is a morning train at 8:30 from Wrocław (the total travel time including changes is 4 hours and 6 minutes), the shortest connection (a direct train from Koleje Dolnośląskie leaving at 13:07) reaches Polanica after 1 hour and 55 minutes. All other connections range from 2 hours 9 minutes to 2 hours 53 minutes. The average travel time to Polanica is 181 minutes. All connections are made by passenger trains.

The same number of trains reaches Duszniki per day. Trains stop in Duszniki in all six cases exactly 21 minutes later than in Polanica, then they reach Kudowa Zdrój 24-30 minutes later than Duszniki. The average journey time to Duszniki is therefore 202 minutes, while to Kudowa Zdrój - 229 minutes.

On weekend days (e.g. Sunday 3rd April), 5 rail connections from Wrocław (including 2 direct) reach Kudowa, and thus Duszniki and Polanica. They leave at 7:21 (direct train provided by Koleje Dolnośląskie), 9:24, 13:07 (direct Koleje Dolnośląskie train), 15:46 and 17:58. Other connections with the need to change trains include taking the Przewozy Regionalne's train to Jaworzyna Śląska or Kłodzko and then using the Koleje Dolnośląskie's busses. All the cited trains are of passenger rank and stop at every station and passenger stop.

**Długopole Zdrój** is located in the southern part of the Kłodzko powiat, on the route from Kłodzko to Międzyzlesie and further from the border with the Czech Republic. The search engine for connections[10] indicates the possibility of 9 trains between the capital of the voivodship and the spa on a business day. These trains depart at: 5:35, 6:34, 8:30, 10:40, 13:07, 14:05, 14:54, 16:46 and 19:31. Only the connection at 13:07 requires travelers to change trains in Kłodzko, the others go directly to Długopole. It is worth adding that some connections are made by international trains reaching the Czech Republic (6:34 to Usti nad Orlici, 10:40 to Lichkov, 16:46 to Pardubice and a train from Kłodzko to Usti nad Orlici connected to the train from Wrocław leaving at 13:07).

The travel time of the entire route from Wrocław to Długopole ranges from 2 hours 3 minutes to 2 hours 20 minutes, which means the average travel time is 132 minutes. On Sunday (3 IV) connections run slightly more rarely - there are 2 trains leaving at 5:35 and 14:05.

The Małopolskie voivodeship has plenty of towns with the status of a health resort. They include: Swoszowice-Kraków, Rabka Zdrój, Piwniczna Zdrój, Żegiestów Zdrój, Muszyna and Krynica Zdrój - as towns with active passenger connections.

**Swoszowice-Kraków** and **Rabka Zdrój** are located on the route leading from Kraków Główny to Zakopane. From Kraków Główny, a large part of the trains reaches Kraków Płaszów, where long-distance train locomotives are unhooked to the other side and change the direction. This arrangement of the communication network largely forces passengers to reach Kraków Płaszów station and frequent transfers. Some trains go directly from Kraków Główny in the direction of both spas (Swoszowice and Rabki), however it includes a pause in the travel (because of the change of direction). That is why in this work it was decided to examine the transport accessibility from Kraków Płaszów.

For example, on the date of May 25 (business day - Wednesday), selected from the scope of the examined timetable, Swoszowice can be reached from Kraków Płaszów by the following passenger trains: 3:59, 6:28, 7:47, 8:21, 10:27, 12:54, 14:29, 15:50, 16:04, 16:26, 16:53, 18:00, 18:30, 19:01 and 19:53. Apart from these 15 passenger connections made by the Przewozy Regionalne company, there are no express trains. This is probably due to the fact that the Kraków-Swoszowice stop is located within a large urban center, which is Kraków, but in its peripheral part. Long-distance trains stop within the city only at central or interchanging stations (stations: Kraków Główny and Kraków Płaszów). The Kraków-Swoszowice station belongs to agglomeration traffic, hence the number of connections is high. In the period from 6:25 to 8:25 three trains were provided (on average at every hour), and during the afternoon peak traffic for those returning from work and from school (between 15:00 and 17:00) there are as many as 4 connections (with an average 30-minute cycle). Trains cover this section from 11 to 14 minutes (on average in 12.5 minutes - rounded up to 13 minutes). On Sunday, May 29th, 13 trains run between Kraków Płaszów and the spa part of the city. The changes compared to business days are that in the morning the system shows a connection through Skawina (by TLK train to Skawina at 4:54, then change in Skawina and arrival in Kraków-Swoszowice at 5:32). In total, the connection lasts 38 minutes. In addition, the weekend schedule includes a 9:20 train, and trains running on business days at 3:59, 10:27, 12:54 and 19:53 are not included. During the day there is a break from 9:20 to 14:29, when there is no train running towards Swoszowice.

On a business day (May 25th, Wednesday), 4 trains a day travel from Kraków Płaszów to Rabka Zdrój. The first train – passenger train provided by Przewozy Regionalne, leaves at 7:47, another trains of the same category and company run at 12:54, 16:53 and 19:01. They cover the route in from 128 minutes up to 147 minutes (on average 138 minutes). On Sunday (May 29th) there are more connections, but most of them are not direct. The system on the website [www.rozklad-pkp.pl](http://www.rozklad-pkp.pl) shows the following Sunday connections: 4:54 (TLK long-

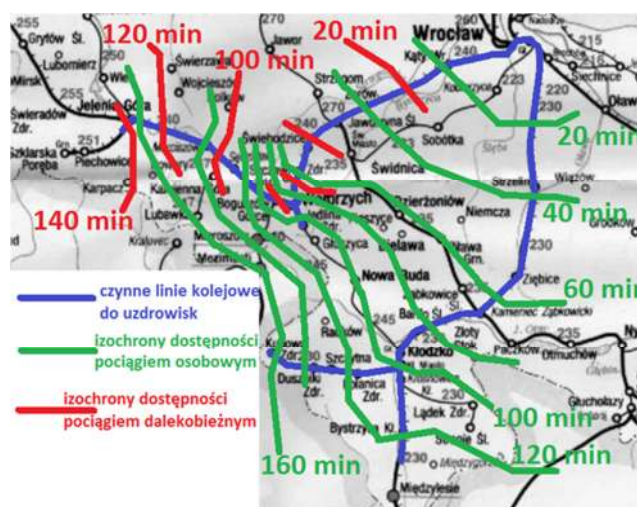
distance train to Chabówka, then Passenger Regional Transport train), 7:47 (direct, passenger), 9:15 (TLK long-distance train to Chabówka, then the Przewozy Regionalne passenger train after more than 4 hours of waiting for a change), 11:54 (InterCity Express to Chabówka and a passenger train to Rabka), 16:53 (direct, passenger train), 19:01 (two Przewozy Regionalne's passenger trains - the first to Sucha Beskidzka and the second after an 8-hour stop to Rabka). As you can see, the two Sunday connections are not very attractive for potential tourists due to long waiting time for change (over 4 and over 8 hours, respectively). However, these connections were shown in this analysis because they were displayed by a computer system and appeared in the rail connections search engine. The average journey time on Sunday is therefore extended due to these time-consuming connections and is about 6 hours and 20 minutes. The result, however, is not reliable. In order to make it more similar to the real one, it would be necessary to reject connections with such a long waiting time for the second train when measuring the average travel time. After rejecting both of the too long connections, values remain in the range of 2 hours 11 minutes - 4 hours 31 minutes (average 201 minutes).

Another group of Małopolskie's health resorts is located in a large concentration, along the Poprad river valley, in the Beskid Sądecki. These statutory health resorts include: **Piwniczna Zdrój**, **Żegiestów Zdrój**, **Muszyna** and **Krynica Zdrój**. They all lie in the said order and on the same railway line connecting Tarnów with Krynica which is a branch heading south of the important transport route connecting Krakow with Lwów (through Tarnów, Rzeszów and Przemyśl). There are not many direct trains from Kraków Płaszów (due to the greater distance) (1 a day on weekdays), in other cases a change in Tarnów is necessary. The connections shown in the search engine include about 4 possibilities of travel to Krynica (via Piwniczna, Żegiestów and Muszyna): first of all – a morning direct passenger train of Przewozy Regionalne at 6:26 (reaching Piwniczna Zdrój at 10:04, to Żegiestów at 10:29, to Muszyna at 10:46 and finally to Krynica at 11:11); secondly - another morning passenger train at 8:10 to Tarnów at 9:29 with the need to change to a passenger train over 4 hours later (at 13:38) and arriving at health resorts at 16:06 (Piwniczna Zdrój), 16:32 (Żegiestów Zdrój), 16:56 (Muszyna) and 17:21 (Krynica Zdrój); thirdly - the InterCity train departing from Krakow Płaszów at 9:55 and reaching Tarnów at 10:50, then the need to wait until 13:38 for the passenger train described in the previous connection; fourthly - afternoon connection including two Przewozy Regionalne's passenger trains (at 14:37 to Nowy Sącz and at 18:15 from Nowy Sącz to Krynica - stopping at Piwniczna Zdrój at 18:41, in Żegiestów Zdrój at 19:11, in Muszyna at 19:27 and in Krynica at 19:52).

On Sunday (on the example of 29th May) there are the same number of connections from Kraków Płaszów to Krynica and the spas located in its vicinity (4), with the difference that more direct trains were included in the timetable. The first leaves at 3:08 (TLK long-distance train) and reaches the health resorts at 6:28 to Piwniczna Zdrój, at 6:52 to Żegiestów Zdrój, at 7:08 to Muszyna and at 7:41 to Krynica. The second train - also running on business days - sets off at 6:26. The third connection is a TLK direct long-distance train departing from Krakow at 8:55 and arriving at the health resort Beskid Sądecki at 11:58, 12:23, 12:38 and 13:11. The fourth connection - just like on business days - with a need to change trains in Nowy Sącz.

The average journey time from Krakow Płaszów to Piwniczna oscillates between the fastest direct connection on business days (218 minutes) and the slowest with a need to change (244 minutes) is exactly 231 minutes. The journey to Żegiestów takes from 243 minutes to 274 minutes (average of 259 minutes); to Muszyna - from 260 minutes to 310 minutes (average of 285 minutes) and to Krynica - from 285 minutes to 315 minutes (average of 300 minutes).

The examined railway lines are marked with blue, while the isochron lines for passenger trains - in green, for long-distance trains - in red. The isochrones were installed every 20 minutes of travel by train (see picture 1).



1. Isochrones for rail access from Wrocław to the statutory health resorts of Poland in the Dolnośląskie Voivodship. Source: personal research - Michał Grzegorek

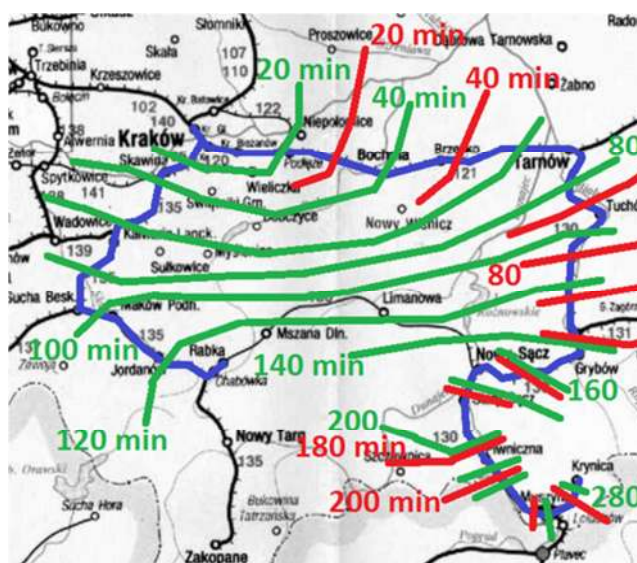
In southwestern Poland, health resorts are concentrated in the Dolnośląskie Voivodship. From the capital of this region - Wrocław - there are two railway lines to the health resorts - the first towards Wałbrzych (with a branch to Jedlina Zdrój) and further to Jelenia Góra Cieplice and the second - towards Kłodzko (with two branches - towards Kudowa and Długopole). You can get to Jedlina Zdrój from Wrocław by a passenger train within 103 minutes, to Cieplice Śląskie (the spa district of Jelenia Góra) - in 171 minutes choosing passenger trains, 149 minutes by medium long-distance train. To Kłodzko spas, the travel time from Wrocław is as follows: to Długopole - 132 minutes, to Polanica 181 minutes, while when analyzing timetables it was shown that the shortest time connection by passenger train takes only 115 minutes (and it was taken into account when setting out the isochrones). Thus, the train to Duszniki travels this route in 136 minutes and to Kudowa Zdrój - 163 minutes. Isochrones from Wrocław to the health resorts of the Lower Silesian Voivodeship are presented in Figure 1.

Difficult and hard for rail development to access terrain in the southern part of the Dolnośląskie Voivodship, which is caused by the surface shape, may be the weakness of the rail situation in the area. On the other hand, a large number of tourist destinations and statutory health resorts as well as a dense railway network can be seen as strengths. The condition of the railway infrastructure is also a big problem, which is particularly visible on the maps in the form of isochron density. The poor condition of the tracks and the low average speed of rail vehicles contribute to the long journey from Wrocław to Dolnośląskie's spas. In turn, the existence of large urban centers and relatively large urbanization of the area is an opportunity to launch a large number of connections allowing passengers to be distributed around the region, including to health resorts. This may affect the more frequent decisions of otherwise non-mobile potential tourists to travel to, for example, Kudowa Zdrój or Cieplice. Big cities - like Wałbrzych or Jelenia Góra - are themselves emission locations. With such a relatively short distance from spas to these cities, short-term tourist traffic should be expected, e.g. weekend trips. Time distances from Wałbrzych to Jedlina Zdrój and from Jelenia Góra to Cieplice Śląskie are within one isochrone, i.e. up to 20 minutes. The situation of travel from the capital of the voivodship looks a bit worse. The fastest way to get to the



Jedlina Zdrój spa is from Wrocław (in just over 100 minutes), the longest journey is awaiting the tourists heading to the Kudowa Zdrój spa (over 160 minutes).

The Małopolskie Voivodship has two railway lines leading from the capital of the region to health resorts (line from Krakow to Rabka and to Krynica). The direct connection by morning train departing from the capital of the voivodship at 6:26 was adopted in this work as the „average rail connection” from Krakow Płaszów to Rabka (via Kraków Swoszowice). According to the timetable of this passenger train, the station in Piwniczna is reached after 218 minutes of travel, the station in Żegiestów - after 243 minutes, the station in Muszyna - after 260 minutes and the final station (Krynica Zdrój) after 285 minutes. For long-distance connections, the train described earlier on Sunday and leaving the Kraków Płaszów train station at 8:55 (TLK train) was adopted. It reaches Piwniczna in 183 minutes, Żegiestów (208 minutes), Muszyna (223 minutes) and Krynica (256 minutes). Isochrones from Krakow are shown in Figure 2.



2. Isochrones for rail access from Krakow to the statutory health resorts of Poland in the Małopolskie Voivodship. Source: personal research - Michał Grzegorek

The exceptionally long travel time from Kraków to the health resorts of the Beskid Sądecki (Piwniczna, Żegiestów, Muszyna and Krynica) does not encourage using rail transport. The time at the level of over 240 minutes, i.e. 4 hours (in the case of an express train journey from Kraków Płaszów to Krynica) is longer than a long-distance train journey from Krakow to Warsaw. In addition, the route is not executed in the most straightforward way due to the terrain. The relatively rare network of red isochrones on the section from Krakow to Tarnów shows that trains run faster, but after Tarnów the situation is getting worse. The line enters a foothill and mountain areas, winds up in many bends, which slows down the journey time. Despite the electrification of the whole route, trains are not able to reach significant speeds. Many sections of this line have speed limits of 60 km / h, which means that rail transport encounters great difficulties when competing with road transport for passengers arriving from Krakow. The Kraków - Zakopane line is struggling with similar problems, where two health resorts are located: Swoszowice and Rabka Zdrój. The difficulty on both lines from Krakow is the need to change direction, e.g. at Sucha Beskidzka or Muszyna stations. Trailing the locomotive and its maneuvers at the station leading to locating it on the final or on the initial part of the train composition take a lot of time and cause an extension to the entire journey. In case of the electric sets this problem is limited to the transition of the train crew from the front to the rear of the unit. These stops are included in the timetable.

With a difficult to clearly indicate rank of the number of connections in relation to the rank of travel time, the author of the article decided to assign the spas to four proposed categories:

1. health resorts with a large number of connections (above average) and short travel time (below average) - which were technically named a spa of **NEIGHBORHOOD COMMUNITIES**;
2. health resorts with a small number of connections (below average) and short travel time (below average) - which have been termed spas of **MISSED OPPORTUNITIES**;
3. spas with a large number of connections (above average) and long travel time (above average) - which were technically called **TOURIST EXPANSION** spas;
4. spas with a small number of connections (below average) and long travel time (above average) - which have been termed spas of **LOW PERFORMANCE**.

The phrase "*neighborly communication*" suggests a close location while maintaining relationships. According to the author, this phrase perfectly reflects the nature of health resorts with a large (above average) number of connections and in the direct circle of influence of the capital city, often in the vicinity (e.g. Cieplice Zdrój in relation to Jelenia Góra).

In the case of the spa's proximity to a big city, which the capital of the voivodship undoubtedly is, but in a situation of a small number of connections available, one can speak of a "*missed opportunity*". It is understood as the waste the potential of having a railway line, for example, for agglomeration or tourism purposes – resulting from the town's possession of the health resort status. The "*missed opportunity*" combines the existence of railway infrastructure and the possession of a tourist destination near a large city with the simultaneous lack of recognition of the opportunity for mutual development - both for the big city (capital of the voivodship) and the suburban spa. This development from the point of view of the capital of the voivodship may consist of redirecting the passenger flows to the capital, increasing labour resources, urban development of the capital - spa relations, relieving the road transport on the same line, introducing ecological forms of transport, which include trains. The development in question, considered from the point of view of the spa, consists primarily of improving transport accessibility, attracting crowds of tourists for periods of rest, e.g. weekend, stimulation of economic development, influx of potential tourists who do not have their own means of transport, increasing attractiveness and competitiveness in relation to others spas. The lack of recognition of the development possibilities resulting from launching a larger (than average) number of rail connections at such a favorable location as the proximity of a large agglomeration and with the existing and active railway infrastructure is defined by the author as an "*missed opportunity*".

There is a group of spas that, despite their distance from the capital of the voivodship, maintains a large (above average, above average) number of rail connections. Due to the considerable distance, often at the borders or peripheries of the region, in the case of these numerous connections, one cannot only talk about the agglomeration nature of these railway lines. Daily commuting longer than e.g. 2.5 hours in one direction seems to be the limit of human endurance, as it leads to the situation that the employee spends 5 hours a day traveling to the place of work. Such a situation may take place in the case of regions with a large diversity in terms of employment, where on the outskirts of the province there is an extremely high unemployment rate, while in the center - in the capital – unemployment rate is low. However, in most cases, the large number of connections on such a railway route is not only linked to employment rates. It is often the result of large urbanization of the area (e.g. along the Katowice - Bielsko-Biała - Żywiec line) or the existence of attractive tourism destinations. Such areas can be explored by tourists mostly coming from the capital of the voivodship. That is why - for the purposes of this work - the author calls such towns a "*tourist expansion*" of

spas, emphasizing their tourist nature resulting from having the status of a spa. Tourism as a rapidly growing part of the economy can overshadow high unemployment by introducing employment (often seasonal) and reviving the economy of the region. Therefore, when choosing the name for this group of spas, it was not decided to be called "underdeveloped economy" or "high urbanization on the outskirts of the region". The author recognized the tourist function as leading factor in this group of spas and a large number of connections - as a result of research on the needs of clients (passengers) ready to undertake a longer route to explore the region, get to know it, penetrate the space and – take part in "tourist expansion". S. Liszewski referred to similar terminology in 1995, isolating five types of tourism space: space for exploration, penetration, assimilation, colonization and tourist urbanization [5].

The long journey time and low number of connections do not encourage potential tourists to visit this type of spa. In the eyes of tourists, they can be treated as health resorts of "poor reachability", with limited accessibility. The word *poor* used in relation to communication - brings to mind synonyms: meager, miserable, negligent, trace. *Reachability* in the meaning intended by the author - can be treated as a substitute for the word *availability*. "Poor reachability" is not only poor access, but also reaching places where access is lost, access to the ends of the service, somewhere far away. This wording creates the impression that it is almost impossible to get there where there is little reachability. Perhaps it disappears, is barely visible, has marginal significance. Figure 3 illustrates all four types of spas.



### 3. Four types of spas in terms of rail accessibility. Source: personal research - Michał Grzegorek

Among the health resorts in the studied voivodships, the average number of connections per day (business day and holiday) and the shortest travel time expressed in minutes are as follows: Cieplice - 7.5 connections per day and 149 minutes, Długopole - 8 and 123 min, respectively, Duszniki - 5,5 and 136 min., Jedlina - 9 and 83 min., Krynica - 4 and 285 min., Kudowa - 5,5 and 160 min., Muszyna - 4 and 260 min., Piwniczna 4 and 218 min., Polanica - 5.5 and 115 minutes, Rabka - 5 and 128 minutes, Swoszowice - 14 and 11 minutes, Żegiestów 4 and 243 minutes. On average, in the health resorts of the two voivodships examined, the timetable includes 6.3 rail connections per day per week (i.e. with an average tact every 4 hours) and the shortest time to travel to the spa from the capital of the province is 159 minutes, which is 2 hours and 39 minutes.

The lowest number of connections (average for working days and weekends) can be found in spas located on the outskirts of the country, far from large urban centers. These include: Sądecki spa (Piwniczna, Żegiestów, Muszyna and Krynica) - on average 4 connections per

day. The low number of connections to Rabka Zdrój (5 connections) and to Kłodzko health resorts, to Kudowa, Duszniki and Polanica (on average 5.5), also stems from the peripheral and borderland locations, although in the case of Rabka the distance from the capital of the voivodship is not so great. The second determinant designated by the author of the typology as a potential factor contributing to a large number of functioning trains to spas is the high urbanization rate of the region. The spa town of Swoszowice (in the Kraków agglomeration) is located in densely populated areas (over 500 people per 1 km square), which provides as many as 14 connections per day. It can therefore be concluded that the urbanization factor is important for the number of connections. The third parameter is the location of an economically important communication route. Many spas are located along the short branch of the railway (e.g. Polanica Zdrój, Długopole Zdrój, Ustroń) or at the end station of such a branch (e.g. Świnoujście, Kudowa Zdrój, and Krynica). Lines that connect, for example, two large agglomerations (two large cities) or a large city and a border crossing, pass through very few statutory health resorts. Among the analyzed health resorts on such routes there is Długopole Zdrój – it is located on the route connecting Wrocław with the Czech Republic.

Among the parameters examined, it seems to be an optimal situation when the travel time from the capital of the region to the spa is low and the number of connections is high. Such a system depends primarily on the geographical location of spas. This group consists of "neighborly communication" spas. The analysis shows that they include: Jedlina, Swoszowice, Długopole and Cieplice Śląskie, which recorded a higher than average number of connections per day with a shorter than average travel time. Similarly to the group of health resorts "unused opportunity" you can include: Rabka, Duszniki and Polanica; to the group of "low reachability" spas - Kudowa, Piwniczna, Żegiestów, Muszyna and Krynica.

Interestingly, no spa qualified for the fourth type - "tourist expansion" spas. All spas far away in terms of travel time from the capital of the region recorded a small number of connections (maximum 5.5 per day). A conclusion can be drawn, therefore, that the further the distance from the capital of the region to the less connections. Inevitably, distance affects travel time, although this can be shortened by investing in electrification of the line. Of the health resorts examined, only 4 of them did not reach the electrified tracks (to Jedlina Zdrój, Kudowa, Duszniki and Polanica Zdrój). The lack of electrification has increased travel time and reduced availability.

Another important factor that undoubtedly influenced the research results was the presence or absence of long-distance connections to spas. It increases the chance for a quick connection of the spa with distant urban centers scattered throughout the country. Long-distance trains in Poland do not reach (in the studied timetable) the following spas: Jedlina Zdrój, Kłodzko spas (Kudowa, Duszniki, Polanica and Długopole), Swoszowice and Rabka Zdrój.

To sum up - the best rail access is characterized by the health resorts of the "neighborly communication" group. Among them, the highest values of the number of connections indicator with the lowest travel time were recorded by Swoszowice as a district of Kraków. The worst time parameters for getting to the spa town and the low number of connections per day were recorded by Krynica. If special attention was given to the presence of electrification and long-distance connections - the weakest result of availability would be recorded by Kudowa Zdrój. Obviously, these results refer to places where there is rail traffic.

It should be remembered that similar studies based on the proposed typology can be carried out in relation to transport accessibility, e.g. by road transport. Then, the statement of the geographical location relative to the center of the system - the capital of the voivodship - will be contrasted with the number of bus connections or e.g. the volume of car traffic measured in separate studies. Also, the center of the system can be changed, referring to all the tests carried out, e.g. to the capital of the country or any other place, depending on the needs. The subject of research may also change - instead of spas, you can explore e.g. ski resorts, seaside

resorts, national parks or other thematic groups of spatial elements. Interesting conclusions can be made by comparisons of typological studies of a given group of localities carried out for several types of transport and then compared. The author of the article hopes that the presented and developed typology method will be reflected in future research leading to a better understanding of the relationships and common relationships between tourism and transport. Research using the method may allow to capture strengths, weaknesses, opportunities and threats in the economic development of a given region, which in turn may condition further actions taken to improve or maintain the situation.

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