Inter-voivodeship railroad routes as a result of the process of regionalisation of passenger rail transport – the example of Poland

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Abstract: *The increasing role of rail transport in passenger mobility has become the focal point of transport policy in Poland in recent years. Organisational reforms of the Polish transport system have led to the transfer of responsibility for regional passenger rail transport to provincial governments. In addition to the carrier originating from the PKP group (PolRegio), local railway companies (e.g., Koleje Dolnośląskie, Łódzka Kolej Aglomeracyjna) are becoming increasingly important and are gaining an increasing share of the rail transport market. The administrative border of a voivodeship should not be a limitation in creating a transport offer. The public transport system should be based on real functioning connections. The analysis concerns all active inter-voivodeship routes in Poland – adopting a comprehensive approach that includes the whole country, not just selected sections. The main objective of the study is to assess their functioning within passenger connections in the context of multilocation travel. A total of 91 routes were identified. The study covers the following characteristics: status in passenger traffic service, categories of trains running, transport offer, road speed, electrification, and date of suspension of passenger traffic. The main conclusions include: [1] there is a strong variation in the number of trains on individual routes, [2] the degree of cooperation between individual provincial governments is uneven, [3] the regionalisation processes carried out in Poland in the passenger transport sector have influenced the emergence of contact connections at internal borders, [4] the regional railway line in many cases constitutes an important transport link (with only a limited role or even absence of bus/coach transport). The study could form the basis for further analysis in terms of network links, assessment of the relevance of reactivating (and operating) defunct rail routes, and strategic planning for the operation of rail routes contained in planning documents. An extended analysis could additionally help mitigate the negative effects of transport exclusion. The analysis aims to demonstrate the impact of administrative and legal changes in rail transportation systems on current transportation links. The study refers to Polish reality as a case study of a Central European country, but the research problem is universal, and the conclusions and recommendations developed can be applied to other transport systems undergoing change and transformation.*

Keywords: *rail transport, public transport, regional services, inter-regional trains*

Introduction

Rail transportation is becoming an increasingly popular means of public transportation in Poland. This is confirmed by the latest data from the Office of Railway Transport (UTK 2023), which show an increasing number of passengers using rail transportation services. In 2020, 209 million passengers were transported, and in 2022, the number grew to as many as 342.2 million. This represents a return to the level of passenger demand back in 2019, before the restrictions related to the epidemiological situation (335.9 million). According to UTK

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data, the largest passenger carriers by number of passengers carried include (UTK 2023): PolRegio (25.47% share of the passenger transport market in 2022), Koleje Mazowieckie (17.26%) and PKP Intercity (17.23 %).

The strong role of regional and provincial carriers is evident. Taking into account the latest reports (UTK 2023), it should be pointed out that based on the share of passenger carriers in terms of freight work in 2022, PKP Intercity serves about 58% of the market in this respect. This is followed by PolRegio (17.37%) and Mazovian Railways (7.56%). This means that despite the relatively small amount of transport work, intra-regional companies are responsible for a large percentage of passengers carried.

Rail links are becoming an increasingly important element of transport systems. The links serviced by passenger (regional) connections are important. These can be intra-regional, sometimes forming part of urban railways (Zajfert 2012). However, interregional links that cross a provincial border are important and should not be a barrier to the organisation of the transport system (fig.1). It, therefore, becomes increasingly important to seek to coordinate the organisation of rail transport in this respect. Forced transfers (e.g. at voivodeship borders due to lack of coordination) may result on the one hand in longer journeys and on the other in potential passengers perceiving rail transport as unattractive.

One of the main determinants of the current regional rail transportation system was the processes of localisation and regionalisation of railroads carried out in previous years (Taylor and Ciechański 2010).

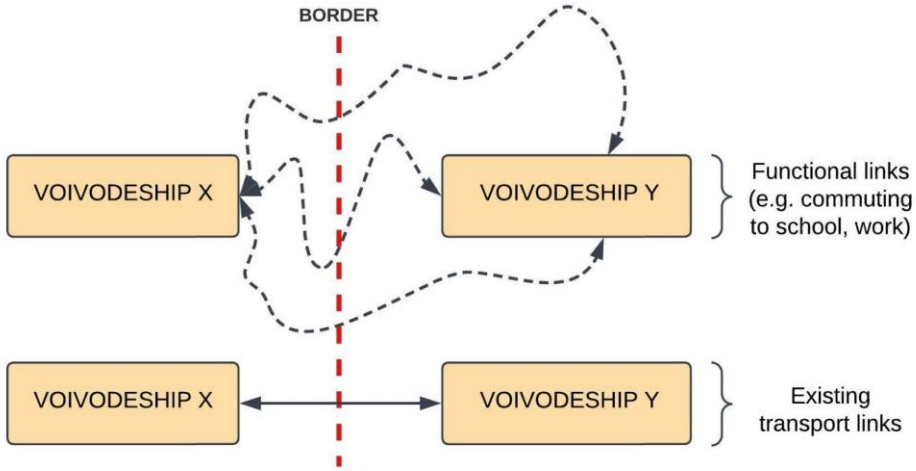

Fig. 1. *Functional and current existing transport links (rail)*
Source: own elaboration

Public transport systems are changing on many levels (administrative, legal, organisational, among others). Their impact on the actual shape of transport links is an interesting research problem. Conclusions that might result from such an analysis can be a source of recommendations for transport organisers. In the literature, there are studies (Taylor and Ciechanski 2006, 2010, 2011, 2017) on the organisational aspect of the regionalisation and self-governance processes of the rail transport sector. The following analysis fills the research gap, as it was developed for the whole country, all inter-regional connections in Poland. It focuses on spatial effects, understood as transport connections available to the passenger. The study, therefore, answers the question of how organisational changes (in this case, the increase in the importance of individual regions in creating a system of rail links) affect the real shape of transport connections.

Research area, methods, purpose

All active (according to the railroad infrastructure manager) interprovincial rail lines in Poland crossing provincial ("voivodeship", "region" are used interchangeably in this paper) borders were taken as the subject of the study (fig. 2). The survey was carried out according to the status as of 16/12/2024. The analysis identified 91 active rail routes crossing provincial borders included in the list of PKP Polskie Linie Kolejowe (PKP PLK). A map portal provided by PKP PLK, book railroad atlases (Stankiewicz and Stiasny, 2014, Stiasny 2022) and the PKP PLK website were used to select the final list of sections crossing provincial borders.

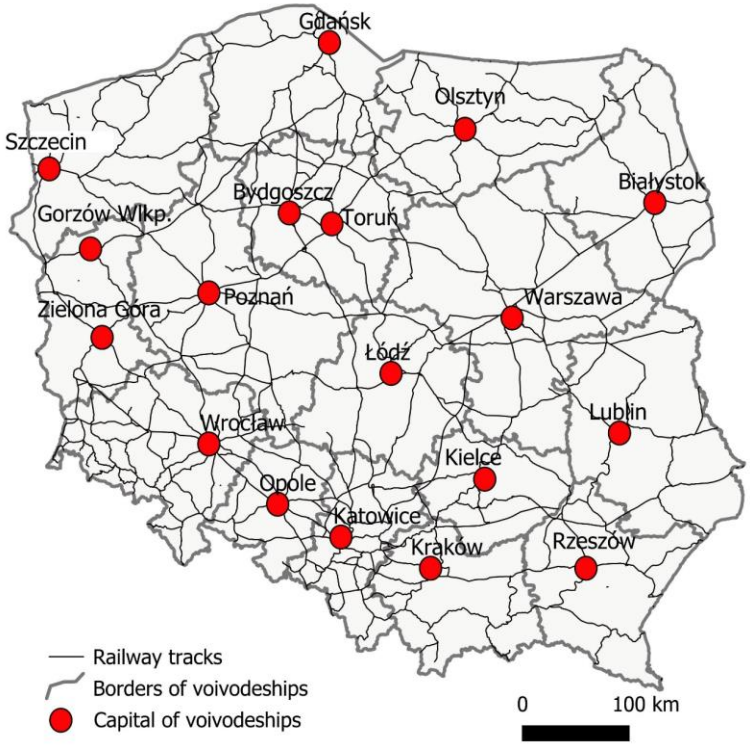

***Fig. 2**. Area of research; Source: own elaboration*

The analysis covers only regional (passenger) trains operated through provincial governments. A catalogue of characteristics describing the studied sections of the rail network was created (tab. 1). In assessing the operation of the rail route, it was assumed that the most important element influencing the perception of rail transportation would be an adequate offer as this is the main incentive for potential passengers willing to choose this mode of transportation or for those currently using the railway's offer. The selected features (tab. 1) can be divided into two working groups. The first 3 features relate to quantitative characteristics, concerning whether the line is active and what kind of traffic it operates. The others regard the number of trips per day, the date passenger traffic was suspended, speed and whether the line is electrified. Speed (which affects the efficiency of travel) and the number of services per day are very important elements that affect passengers' perception of rail as a mode of transportation (Paha et al. 2013, Pan et al. 2017, Oliveira et al. 2019). The date of suspension of passenger service is an element that can characterise the validity of a route in the regional system. In Poland, cancelling railroad services had for many years been a very significant

problem affecting the simplification and depletion of passenger connections (Koziarski 1993, Taylor 2007, Taczanowski 2012). The phenomenon of rail network coverage regression also affected other Central and Eastern European countries (Król and Taczanowski 2016). It would be interesting to base the analysis on existing passenger streams (Komornicki et al. 2013), but this type of data is very hard to obtain from provincial governments (Smolarski 2023).

Tab. 1. *Aspects characterizing the routes analyzed and the data sources used in the study*

Issue	Data source
Is the route open to any rail traffic?	PKP PLK documents; Stiasny (2022)
Is there passenger (regional) traffic on the route in question?	Railroad timetable provided by PKP PLK and carriers; Bocheński (2022)
What categories of trains serve the route (freight, passenger, mixed)?	
Transportation offer	Passenger train service offer railroad timetable provided by PKP PLK and carriers
Suspension of traffic	Date of suspension of passenger traffic Koziarski (1993), Stankiewicz and Stiasny (2014)
Speed	Route speed PKP PLK documents and PKP PLK map portal; (Stankiewicz and Stiasny 2014)
Is the route electrified?	

Source: own elaboration

The main objective of the study was to determine the characteristics of inter-voivodship regional railroad connections with particular attention to the organisational and spatial aspects. In addition, the final conclusions can provide a basis for changes in the framework of the operation of regional rail transport systems. The research question is: are the effects of the regionalisation processes of rail transport in Poland visible on the example of current railroad connections in the infrastructural and functional aspects? The results of the study will be presented in the same order as the aforementioned characteristics of each route.

Operation of passenger rail transport

The issue of the organization of the operation of passenger rail transport is an issue often discussed in the literature on the subject (Taylor 2004, Beria et al. 2012, Alexandersson and Rigas 2013, Tomeš et al. 2014, Bergantino et al. 2015, Kołoś et al. 2017). Carbajo and Sakatsume (2004) highlighted elements determining changes in the operation of rail transportation systems, including: liberalisation of the passenger and freight market, changes in freight tariffs, and separation of infrastructure managers from carriers. In Poland, recent years have marked very intensive changes at the ownership and organisational levels. In terms of ownership transformations, attention should be paid to the processes of change of the Polskie Koleje Państwowe (PKP) from a state-owned enterprise (monolith) to a single-person company of the State Treasury (Taylor and Ciechański 2010, 2011, 2017). The previous structure showed many barriers to development, including inadequate passenger transport offer, inefficient organisation of transport work, excess of unproductive elements of railroad assets, numerous railroad properties requiring significant funds for ongoing maintenance (Engelhardt 2021). In 2001, there was a separation into infrastructure managers, passenger carriers and freight carrier sectors (fig. 3). A similar change took place in many European countries (Nash 2008).

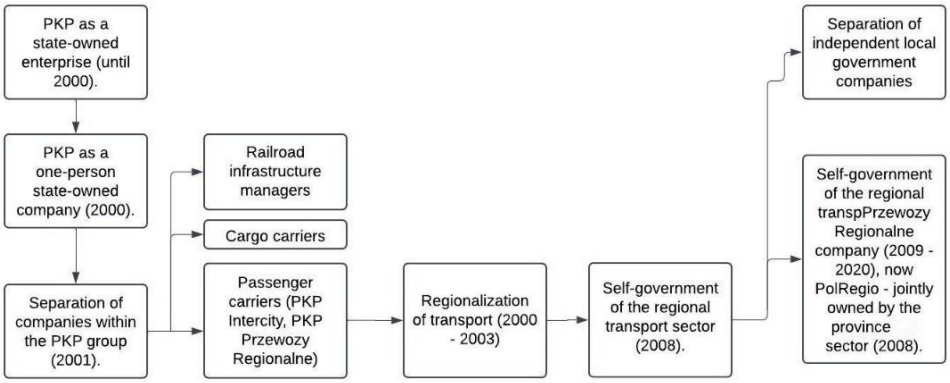

***Fig. 3**. Transformation of the rail transportation sector*
Source: Smolarski (2022)

One of the most important organisational changes in Poland was the division between the organisers of interregional and international rail transport (fast, express, long-distance), and regional and local (intra-regional) connections. This process was important for improving the functioning of the regional transportation system (Massel 2005) and it is the main factor determining the current shape of the rail transport system in Poland. It constituted one of the most important processes of change on the European rail transport market (Mężyk 2019). Currently, in Poland, long-distance connections operated under the so-called "open access" are a definite minority (e.g., Cracow - Prague operated by LeoExpress on selected days of the week). Negotiations are underway to launch trains from Cracow to Gdynia and from Warsaw to Cracow (RegioJet company). In the Polish system, the entity responsible for admitting carriers under "open access" is the Office of Rail Transportation (Urząd Transportu Kolejowego, UTK).

Another important process was the regionalisation of the rail transportation sector, which involved regional (provincial) transportation. A group of 16 provincial rail transport organisers emerged from the national unified organisational structure, where the central authorities were responsible for rail transport throughout the country (fig. 4). The result then was the need for joint efforts, establishing rules for co-financing interprovincial transport, and an adequate organisation of rail transport.

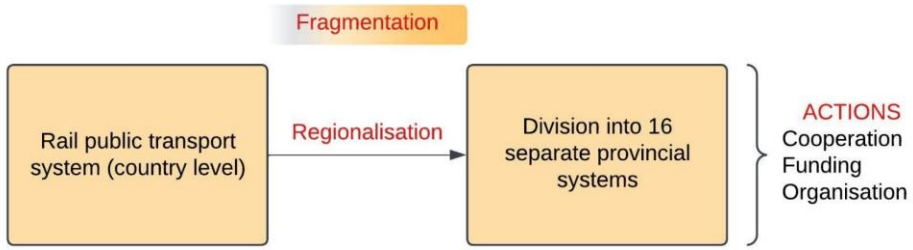

***Fig. 4**. The process of regionalization of rail transport in Poland*
Source: own elaboration

The issue of regionalisation of rail transport understood as the transfer of responsibility for this mode of transport to provincial governments (Massel 2004, Górny 2016) was an element of the planned transport policy of the state already in the 1990s (Mężyk and Zamkowska 1998, Konradiciuk and Gabryś 1999, Żurkowski 2000). Research in this area regarded various foreign railroad systems, including Switzerland (Mężyk 1999), Germany and France (Massel 2004). Regionalisation was defined as "the delegation of responsibility from the state to local government" (Massel 2004).

The process of rail regionalisation in the Czech Republic, Austria and Germany was the subject of a study by Seidenglanz et al. (2015). They indicated that the regional rail linkage model functions best in the Czech Republic and Germany. It was shown to function relatively badly in Austria, where the organisation of local/regional transport is highly centralised. The individual regions have to adapt to a centralised timetable. In Germany and the Czech Republic, on the other hand, the way in which transport provision is set up is more decentralised and dependent on individual local authorities (Seidenglanz et al. 2015).

What is more, one of the additional elements determining the current shape of regional connections was also the issue of financing intra-regional transport. In the initial phase, they were financed by the central government. However, subsequent legal changes (Ustawa 2003) affected the total financial responsibility of provincial governments in this regard. The main objectives of the regionalisation of railroads can be named as follows (Mężyk 2019):

1. improving access to transportation for lower-income population groups,
2. better management of public transportation,
3. increasing the attractiveness of public transportation,
4. introducing mechanisms based on regulated competition,
5. improving the rationality of spending public finances.

The regionalisation process is also associated with a differentiated system of operation of regional railroad companies in different regions of the country:

1. cooperation of local governments with Pol Regio; currently Pol Regio is the backbone of the rail transport system in 11 voivodeships; in the Mazowieckie region it plays a minimal role and in the other 4 it carries out transport in parallel with provincial companies (Łódź, Silesia, Lower Silesia and Greater Poland),
2. creation of local governments' own transport companies,
3. tender-based implementation of rail transport.

Legal aspects of the operation of regional services in Poland are important. Provincial rail services were originally considered transportation to the nearest station in a neighbouring region, allowing transfers for further travel or technical reversal of trains. This means that they were only implemented to the nearest station in the neighbouring region. In 2020, the definition was changed, and the current version is transportation to a station in the voivodeship, up to a maximum of 30 km from the border between regions. This potentially influences better methods of creating a transportation system based on functional connections rather than arbitrary rules (Zajfert 2012).

Changes in the operation of regional and interregional passenger trains can also be identified in other Central and Eastern European countries (Taczanowski 2015). The issue of the functioning of Slovak railway systems has been the subject of research by Michniak (2006, 2016, 2018). As in Poland (Komornicki 2011), an increase in the importance of the use of individual transport - own car (Michniak 2006) was found, with a simultaneous decrease in the length of rail infrastructure used (Taylor 2007). In the case of Slovak railways, attention was drawn to the poor technical condition of the infrastructure (Michniak 2016) and the low level of funding (Židová and Čamaj 2022). Michniak (2018) also highlighted the impact of the break-up of Czechoslovakia on the current shape of the railway network and the layout of transport links.

Rail transport systems in Poland, the Czech Republic and Slovakia during the period of socio-economic transition (since 1989) were characterised by different transport policies. In the Czech Republic, the general aim was to maintain a dense network of rail links. In Poland and Slovakia, on the other hand, there has been a significant reduction in the length of rail infrastructure in use (Taczanowski 2015).

Results

The above-mentioned assumptions and data sources formed the basis for the development of the following results and conclusions. This part addresses both quantitative and qualitative aspects related to the subject of the study. The survey found that there are 91 active railroads in the Polish rail transportation system (in terms of infrastructure). Passenger (regional) train traffic is carried out on 70 of them, while the remaining 21 do not run passenger trains. These are routes served by high-speed and freight trains (fig. 5). In the Polish rail transport system, fast trains are organised by central authorities, stopping at fewer stations. In addition, tickets for this category of trains are not honoured on regional trains or vice versa. Consequently, high-speed trains are a separate part of the railway market structure. For a better understanding and knowledge of the location of railway routes, the author suggests using the official map portal of the Polish Railway Lines (https://mapa.plk-sa.pl/) and https://www.bazakolejowa.pl/. The latter portal gives the possibility to search for individual stations and their location on the map.

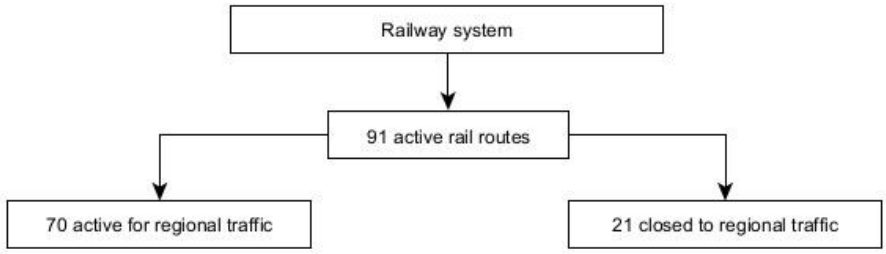

Fig. 5. *Lines included in the analysis.*
Source: own elaboration.

The routes were identified on all interprovincial borders (fig. 6). The highest concentration can be found in southern and southwestern Poland. These are regions with very well developed railroads. This was the former Prussian partition, where rail transportation was an important part of the regional transportation system (Taylor 2007).

An important element characterizing a railroad route is the number of connections per day (fig. 7). The analysis showed a significant differentiation of the studied group of railroads in this respect (tab. 2). On average, about nine connections per day were launched on each route. In the case of four lines, passenger traffic was conducted on selected days of the week (e.g., weekends or Fridays). These were: Hucisko – Jeleśnia, Skołyszyn – Biecz, Paczków – Otmuchów, Pawonków – Fosowskie. The lack of passenger trains on the aforementioned sections on most weekdays basically excludes these routes from the regional transportation system.

Tab. 2. *Number of passenger trains on active rail routes*

Number of pairs of trains per day	Number of train routes
< 2	2
3-5	17
6-9	26
10-13	12
14-20	9
>20	4
Total	70

Source: own elaboration

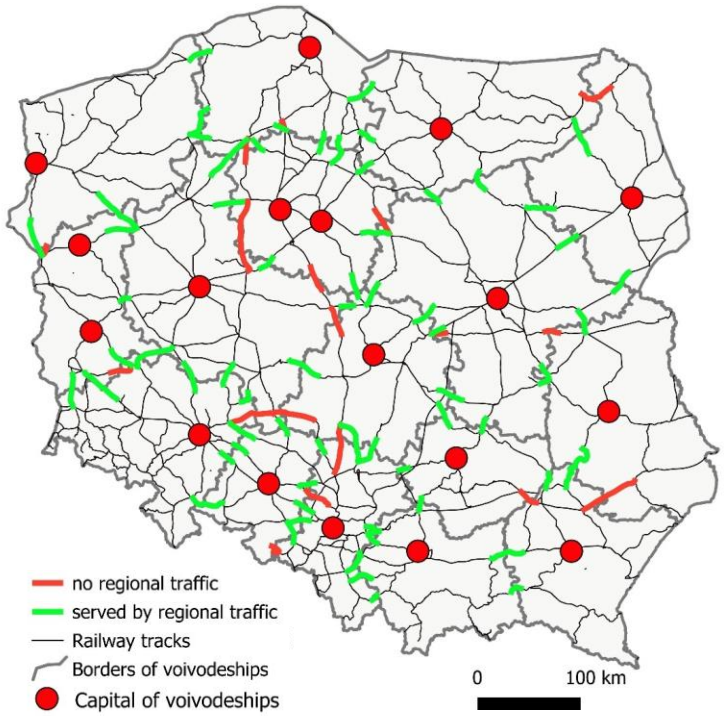

Fig. 6. *Status of inter-regional railway lines; Source: own elaboration*

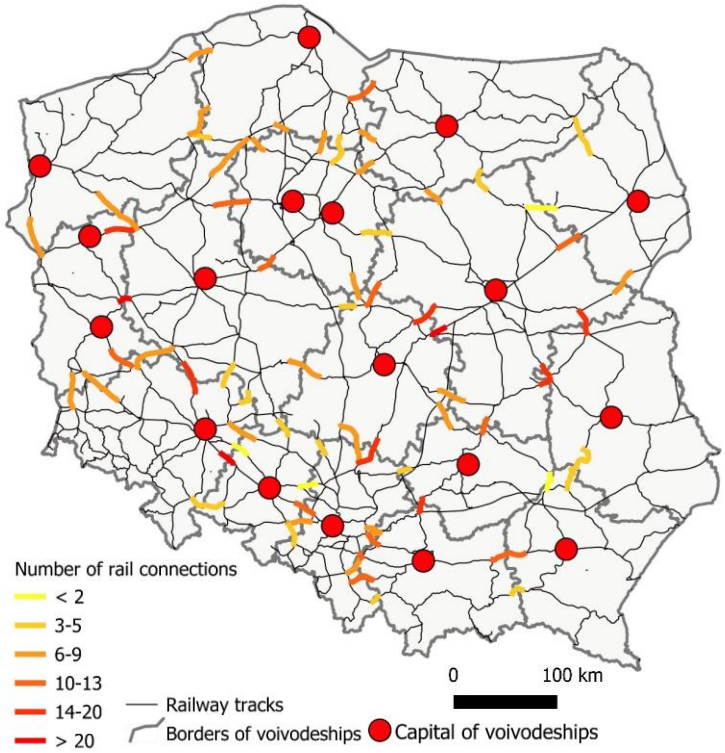

Fig. 7. *Number of pairs of trains; Source: own elaboration*

Routes with very limited service include: Krzewie – Kłodawa (4 pairs per day), Czarne – Szczecinek (3 pairs), Prostki – Grajewo (4 pairs), Biskupice Oławskie – Karłowice (2 pairs on weekdays). In some cases, express connections might be a substitute for transport links. Nevertheless, they will not replace passenger (regional) connections. The most developed transport offer in terms of the number of connections was identified on the main transport arteries.

The survey also included the aspect of identifying the type of rail traffic on the described rail lines (tab. 3). In the case of active routes, mixed traffic predominates (51 lines); 19 routes do not operate high-speed trains. Taking into account routes that are not active in regional traffic, on 5 sections there are only fast trains and freight trains. The remaining 17 lines are served only by freight trainsets.

Tab. 3 *Train categories by line of operation and closed lines in passenger service*

	Train category	Number of lines
Lines active in regional traffic	O, P, T	51
	O, T	19
Lines inactive in regional traffic	P, T	5
	T	16
Total	91	

Designations: T – freight traffic, O – passenger traffic, P – fast traffic; Source: own elaboration

The survey also covered the issue of route closures for passenger traffic. Regarding 19 routes with inactive passenger traffic, the earliest closed line was Chmielów – Strzegomek in 1990. By far the largest number of passenger trains were cancelled after 2000, 15 lines were subject to this change. These included mainly non-electrified local routes, such as: Pietrowice Wielkie – Baborów (suspension of traffic in 2000), Rypin – Sierpc (2000), Chojnice – Więcbork (2000), Niegosławice – Kłobuczyn (2002), Tworóg – Kielcza (2011). The elimination of passenger traffic was also associated with the main routes, with the nature of a trunk line. This type of line are: Skierniewice – Puszcza Mariańska (2004), Miedźno – Działoszyn (2009), Dąbie nad Nerem – Kraski (2012). Even nowadays, in some cases, express trains are running using the above-mentioned sections. However, very often they do not make any commercial stops, and therefore have no impact on the transportation system.

It is particularly problematic to determine a clear date for the suspension of passenger traffic in the case of lines on which the transport offer is based on seasonal connections, such as weekends during school vacations. These are frequently connections of a typical tourist nature and do not constitute a stable element of the transport system. This type of line is the section Bąk - Lipowa Tucholska with occasional passenger traffic. On 3 lines with suspended passenger traffic there are fast trains. These are: Stalowa Wola – Huta Krzeszowska – Biłgoraj, Rypin – Sierpc and Wieruszów – Kępno.

One of the factors in assessing the performance and potential of a given rail route is its adaptation to a certain speed. Considering all analysed routes (active and inactive in passenger traffic), the average speed is 115 km/h (median feature = 100 km/h). For routes served by regional trains, this value stays at 115 km/h. The highest speeds are identified on trunk routes, such as: Czarna Tarnowska - Wola Rzędzinska, Bednary - Sochaczew, Krzewie -Kłodawa, Żmigród - Rawicz, Skierniewice - Żyrardow.

Railroad lines without passenger service have worse technical parameters (average speed is 85 km/h). Some of them are dedicated only to occasional freight traffic, such as from Pietrowice Wielkie (Silesian voivodeship) to Kietrz and Baborów. On these two sections,

the railroad speed is only 30 km/h. On some routes, on the other hand, the speed is above 90 km/h. These include: Chromin – Stoczek Łukowski, Piotrków Kujawski – Zaryń, Miedźno – Działoszyn. It can be concluded that the infrastructure manager PKP PLK strives to maintain a sufficiently high route speed on the routes where passenger connections are made.

The survey showed that 29 routes (34% of the total surveyed set) are devoid of electrification (fig. 8). Such active routes (17 in total) in regional traffic include Iłowa – Ruszów, Skępce – Sierpce, Paczków – Otmuchów, Opoczno – Końskie, Czarne – Szczecinek, Silno – Tuchola. In 12 cases of routes without catenary, there is no passenger traffic. These include: Niegosławice – Kłobuczyn, Bąk – Lipowa Tucholska, Tworóg – Kielcza, Rypin – Sierpc. The other routes (62 sections) are electrified. Passenger traffic is carried on 51 sections. In part, these are routes of an arterial nature, such as: Czarna Tarnowska – Wola Rzędzińska, Brzeg – Oława, Koniecpol – Włoszczowa, Krzewie – Kłodawa. Routes of lesser importance include: Międzybórz Sycowski – Sośnie Ostrowskie, Kozy – Kęty, Hucisko – Jeleśnia. There is no regional passenger traffic on nine railroad lines, such as Brzeszcze Jawiszowice – Czechowice Dziedzice, Wieruszów – Kępno.

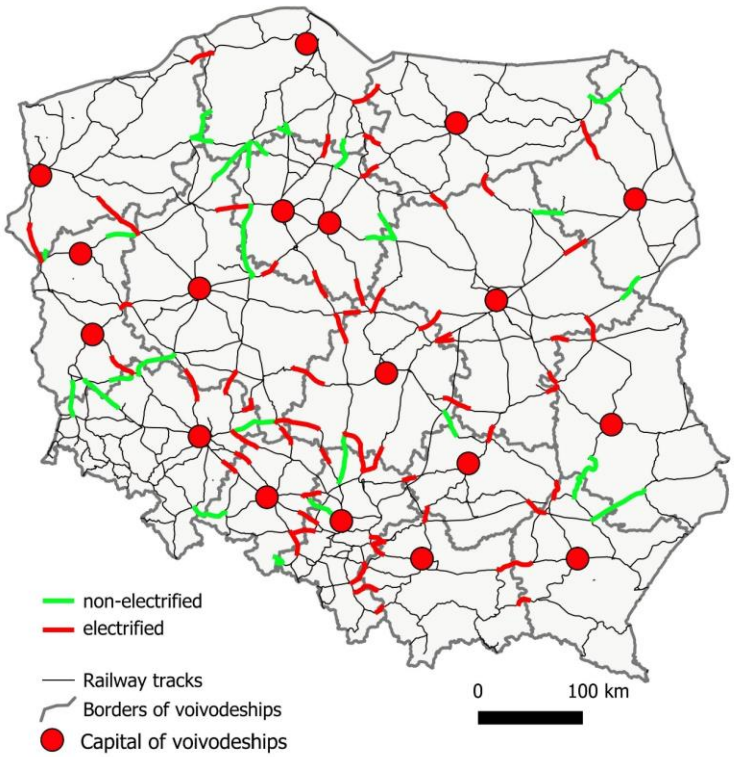

***Fig. 8**. Electrification of rail routes; Source: own elaboration*

As a result of the study, it is possible to determine the interregional boundaries where connections are made in the best way (without major inconveniences for the passenger):

- Dolnośląskie (capital Wrocław) and Opolskie (Opole),
- Opolskie (Opole) and Śląskie (Katowice).

On the other hand, the least effective connections were identified between the following provinces: Podlaskie (Białystok) – Warmińsko-Mazurskie (Olsztyn); Podkarpackie (Rzeszów) - Lubelskie (Lublin).

Discussion

The functioning of the public transportation system is based on many aspects. One of the most important is the transportation offer, understood as the number of connections available to the passenger (Rosik 2016, Kukuliač et al. 2023). The study showed that there is a relatively strong variation in transportation service. The largest number of connections is offered on the main trunk lines, lines connecting large cities (e.g., Wrocław and Poznań, Wrocław and Opole). Servicing the provincial periphery and areas with low population density is becoming problematic. As Ciechański (2023) notes, as a result of organisational fragmentation and barriers to bus transportation, inefficient public transportation in peripheral regions is apparent. The high relevance of rail is highlighted by Parikesit and Susantono (2012) in the context of Asian megacities. It can be assumed that in such a complex public transportation system (with functioning subways and buses), rail plays a key role.

In the literature on the attractiveness of public transport and the idea of its operation, there is a classic division into internal factors (Pan et al. 2017), i.e. those dependent on the carrier (transport offer, quality of service, punctuality, technical condition of rolling stock, ticket prices and promotions) and external (population, land use, number of employees). It can be assumed that in this context the operation of interprovincial routes can be described in two ways. On the one hand, the provincial government undertakes activities related to the organisation of regional traffic, in coordination with the neighbouring regions. In addition, activities related to the acquisition of rail infrastructure from the infrastructure manager are possible. In Poland, this type of solution has become popular in recent years in the Lower Silesian, where several local routes have been taken over (Smolarski 2021).

It is noteworthy that 51 interrail routes operate fast train traffic. Therefore, one option to improve the functioning of transport links could be to increase the number of intermediate stops of long-distance trains. However, this, in turn, could result in excessively long travel times and thus a decrease in the attractiveness of trans-regional transportation. Technical stops (e.g., waiting for the track to be cleared) for some trains have been turned into commercial stops (with the possibility of boarding and alighting). This is one of the solutions that improves transportation accessibility.

Interestingly, studies have shown that if the transport offer is of a high level then passengers pay attention to other aspects of travel and service. These include automatic compensation for delays, high level of passenger information, and a loyalty system (Oliveira et al. 2019). This indicates a certain prioritisation for public transport organisers, which should be based first on the transportation offer and then on other quality aspects. Van Hagen and van Oort (2019) created a pyramid of passenger needs, where they pointed to elements such as reliability of transportation, speed, and safety. In the Polish system of transport links, it can be assumed that it is necessary to act multifaceted in order to further increase passenger demand.

The issue of possible different levels of involvement of local authorities in the organization of rail transport in their region should also me mentioned. Such an example is the Pomeranian region, which, according to UTK data, is one of the leaders in terms of the number of passengers carried. However, the vast majority of passenger traffic is concentrated within the Tricity agglomeration (Gdynia – Sopot – Gdańsk) and the main routes. In the case of regional interregional traffic, it is noticeable that there is a relatively weak transport offer on active routes. This negatively affects the polarisation of the regional rail transport system in terms of supply.

In Poland, the next stage of change in the passenger transport sector is likely to be a process of liberalisation, that is, allowing private companies to operate. As Taczanowski (2012) notes, Poland is an example of a system in which local government carriers are playing an increasingly important role at the regional level. Another likely activity will be the development of long-distance connections. As Tomeš et. al (2014) notes, the introduction of the possibility

of competition between carriers may improve the quality of service and increase the number of passengers (Tomeš and Jandová 2018, Fitzová et al. 2021).

It should be emphasized that experience in other countries shows that the introduction of commercial transport is associated with numerous difficulties and barriers. The study has demonstrated that passenger preferences in using routes from Cologne to Brussels and Amsterdam varied widely, including in the context of evaluating ticket prices and passenger service. It has been shown that the greatest opportunity for high passenger numbers is with established commercial brand start-ups on high-potential routes (Paha et al. 2013). In the context of studies of inter-island connections, it can be assumed that, therefore, potential liberalisation will not affect this segment of traffic in the first phase. It is likely to be related to connections between major agglomerations. Perennes (2017) further pointed out that the opening of the passenger transport market only affects the transport system after some time. In addition, the entry of new carriers is most often based on minimizing financial risks (not using new rolling stock, running on single routes). Bankruptcies and closures are common, according to the survey.

Considering the comparison of Poland to neighbouring countries (Czech Republic and Slovakia), some aspects can be highlighted. As the study by Tomeš et al. (2016) showed, the introduction of open access for carriers (competitors) on the Prague – Ostrava route resulted in a decrease in ticket prices while the timetable changed. It is true that the number of journeys increased, but they became less evenly distributed in the day. In the Polish rail transport system on long-distance routes there is practically no competition between carriers at present. The monopolist is PKP Intercity, which operates inter-regional fast and express services. Nevertheless, the experience of the Czech transport system may be the basis for the process of opening the market to independent carriers in Poland.

The transfer of responsibility to local authorities in the Czech Republic in 2005 was the start of a regionalisation process. Each region dealt with rail links differently. Some based regional transport mainly on rail, while others indicated a priority for bus transport (Seidenglanz et al. 2015). In the Czech Republic, inter-regional connections were found to require interchanges at regional borders in some cases. As demonstrated by Chlumecky et al. (2020) on some routes (e.g. Plzeň-Cheb, Bohumín-Přerov) there has been a decline in the number of direct passenger connections over the years. The phenomenon of necessary transfers at border stations was identified. The authors rightly noted that passengers should not waste time or funds on transfers independent of them (Chlumecky et al. 2020). It was rightly pointed out that if there is coordination of international connections it is all the more possible and necessary for regional connections. Given the phenomenon of the reactivation of an increasing number of rail routes in Poland in recent years, it is important to avoid the organisational errors that have to some extent been identified in the Czech rail transport system.

In the Polish regional public transport system, the creation of a single regional system is difficult. This is due to the fact that the provincial government is responsible for rail connections (Górny 2016). In the case of bus connections, there is no defined single coordinator and organiser. In many cases, bus transport is only provided on the most profitable routes. It can be assumed that the creation of a system based on the interaction of bus and rail transport at the regional level is currently one of the most important challenges of Polish transport policy. A solution that could be implemented in Poland is integrated public transport systems. In the Czech Republic, they operate based on coordinated rail and bus services, which are organised by individual regions (Šťastná et al. 2015).

The regionalisation process can be helpful in restoring rail traffic on disused routes. As Taczanowski (2015) notes, the closures of railway routes were caused by the high cost of maintaining the railway infrastructure. Transferring responsibility to provincial governments may reduce these rates (Smolarski 2021). As the example of Slovakia, where regionalisation began in 2003 (and later in 2011), shows, this process can take many years (Taczanowski 2015).

The survey allowed an attempt to determine the typology of interprovincial links (fig. 9). In the first case, there is no active rail infrastructure link at all. This means that the railroad is either dismantled or completely unusable and is not part of the transportation system in the region. One alternative solution in the context of public transport is the organization of bus services by the provincial governments concerned. Regardless of the solution adopted, the introduction of passenger services should be based on an analysis of efficiency (potential demand). In Poland, it is becoming popular to introduce bus transportation organised by rail carriers on transportation lines without active rail infrastructure (e.g., Rawicz – Góra, Oleśnica – Syców). Commuter lines are becoming a similar solution, complementing the network of public transportation in the region, but their course is not necessarily the same as the railroad infrastructure system (they do not duplicate it).

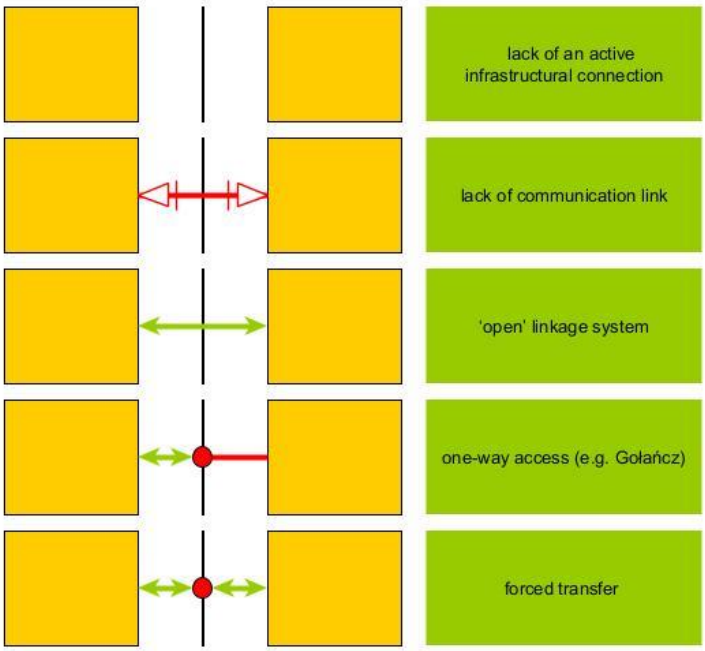

***Fig. 9**. Types of inter-regional rail connections; Source: own elaboration*

The second type of interregional link is characterised by the presence of an active railroad line, but without regional rail transport links. In some cases, the only passenger connection is a long-distance train. However, the lack of stops at most intermediate stations makes this type inefficient for the region's public transport system. The lack of use of rail infrastructure and alternative means of public transport can lead to the aggravation of the negative phenomenon of transport exclusion (Jaroš 2017). Adequate effective use of the region's railroads as a major transportation route (transportation axis) can be the basis for creating a regional transportation system. However, it should be borne in mind that an adequate transport offer and possibly coordination with bus services is very important. This is particularly important in mountainous and peripheral areas (Ciechański 2023).

The third variant of the transport link is the most desirable from the point of view of the passenger (and the possible increase in demand for public transport). In this case, the administrative barrier is not perceptible. An aspect that additionally determines the number of passengers should be an adequate transport offer. In the cases analysed, the largest number of services was carried out on the main rail arteries, connecting the largest agglomerations (e.g., Wrocław with Poznań, Cracow with Katowice).

The fourth option is characterized by the existence of “one-way access”. This means that one of the bordering voivodeships is interested in running traffic to the border of the region (or in the immediate distance, depending on the technical possibilities). However, the other bordering voivodeship does not organise traffic on its side. This type of situation was identified on the Poznań – Gołańcz – Kcynia transport route. In Wielkopolskie voivodeship, trains run to Gołańcz. On the other hand, the Kujawsko-pomorskie region does not organise transport to Kcynia. The route in question (after opening) would be an alternative to Poznań – Bydgoszcz connections. In addition, transportation service to the provincial periphery would improve.

The fifth version of transport links is characterized by “forced interchange” This means that trains from both sides of the border are timetabled in such a way that the potential passenger has to change trains. This type of solution works in the case of travel from Ostrołęka (Mazowieckie voivodeship) to Szczytno (Warmińsko-mazurskie voivodeship). Possible transfers (especially obligatory ones, forced by the timetable and not by other issues) are an element that affects passengers' evaluation of transportation (Petříček and Marada 2022).

The beginning of the 21st century and Poland's access to the European Union (2004) were the beginning of very significant changes in the rail transportation sector (fig.10).

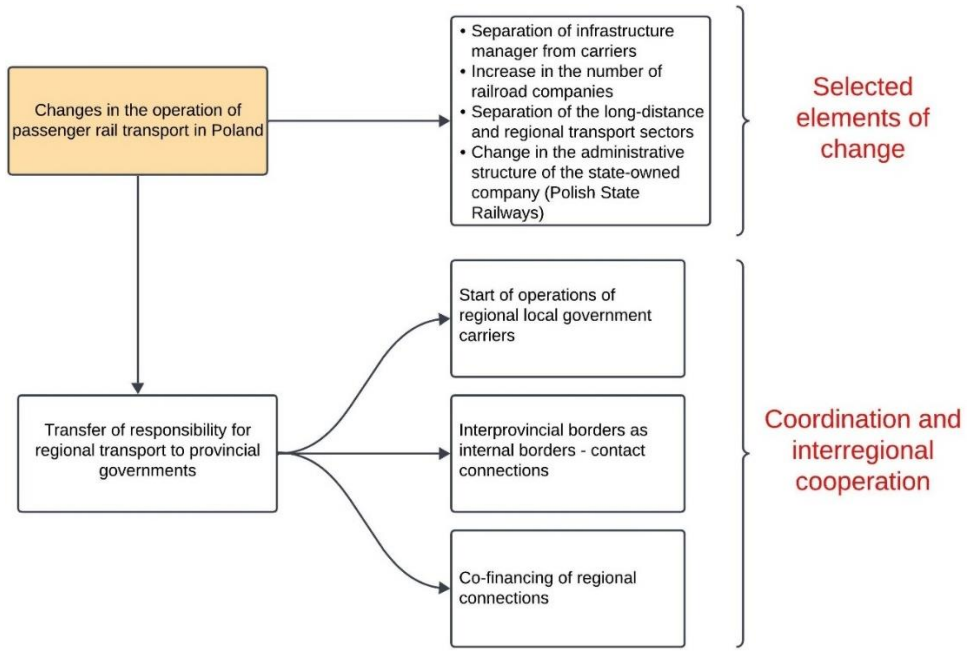

Fig. 10. *Transformation of the rail transport sector in Poland; Source: own elaboration*

First of all, there were organisational and formal changes, related to, among other things, divisions of companies, the formation of new companies, the development of freight transport carried out by private entities (Taylor and Ciechański 2006). In terms of regional transport (passenger trains), one of the biggest organisational changes is the process of regionalisation, that is, the transfer of responsibility for regional transport from the central level to the provincial level (local governments). The organisational effect was the creation of 16 administratively separate organisers of this type of transport. The division of one administrative structure into multiple systems has led to the emergence of internal boundaries in the transportation system. Their effect was the operation of contact links crossing administrative boundaries.

Conclusion

The study focused on the Polish rail transport system which has been subject to many great changes in operation over the past few years. Poland, as a Central European country, functioned for many years (until 1989) in the reality of a communist bloc state (Król and Taczanowski 2016). The rail transport sector then was homogeneous in terms of organisation. The following decade related to numerous closures of sections of railroad lines and a reduction in freight work (Taylor 2007).

The survey was conducted on railroad (regional) connections carried out on inter-regional lines. The analysis showed that 91 rail lines are active. On 70 there is passenger traffic, while on 21 there are only fast and/or freight trains. There are significant differences in terms of assessing their performance, depending on the number of connection pairs and railroad speed.

There is a research gap in the literature between studies of rail systems at the level of a single region and national and international analyses. The peculiarities of the transformation of recent years of the Polish system were an important rationale for the analysis. Interregional links are as important as the connections within a single territorial unit. However, the increase in the mobility of society (Banister 2008) allows us to assume that the role of interregional links (especially in areas of high population density, with strong functional-spatial relations) will increase.

The analysis was based on the principle of comprehensiveness, that is, it covered all interprovincial borders in Poland. This makes the results and recommendations more reliable as they are based on a broader view than a potential study on a smaller spatial scope. The period of 25 years since the beginning of organisational changes in Poland's rail transportation system makes the research problem an element of evaluating the changes from the perspective of the passenger, i.e., considering the status of the line (active/inactive) and the transport offer. The national transport policy indicates the need to adopt the principles of cohesion, namely, to create a comprehensive public transport system. This will be part of reducing traffic exclusion in Poland.

The survey showed that the issue of intercity links is very important, especially in a transport system that is undergoing constant change (in the past). Further organisational transformations are planned, including the introduction of free access to the passenger transport sector. The analysis can form the basis for further extended research in the field:

- network analyses based on the assessment of interregional transportation links implemented between localities with a particular focus on interregional routes. Such an approach would allow, on the one hand, to assess the relevance of already existing railroad lines crossing provincial borders, and on the other hand (after taking into account closed routes) would indicate potentially (in terms of network) important lines
- development of a model of the legitimacy of reactivating railroad routes that are closed for passenger traffic, taking into account functional-spatial connections and the possible use of bus/coach transport (instead of high-cost revitalisation of railroad infrastructure)
- comparison of visions for the operation of interprovincial connections of individual provincial governments in the context of the document.

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