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**The concept and conditions for the creation of the Poznań Metropolitan Railway, taking into account economic, spatial and demographic aspects**

**Abstract:** This article discusses the conditions for creating the Poznań Metropolitan Railway as an initiative by the authorities of the Wielkopolska Province, railway operators, and social organizations. This initiative responds to the transportation needs of residents in the Poznań Metropolitan Area (POM). The goal of the Poznań Metropolitan Railway is to improve the quality of passenger transport in the Poznań agglomeration (hereafter referred to as the Agglomeration) by developing an attractive and efficient network of railway connections within the existing framework of railway transport operations in Poland—significantly cheaper than providing a similar level of transport service by expanding the road network.

**Keywords:** Poznań Metropolitan Railway; railway infrastructure; Poznań Metropolitan Area

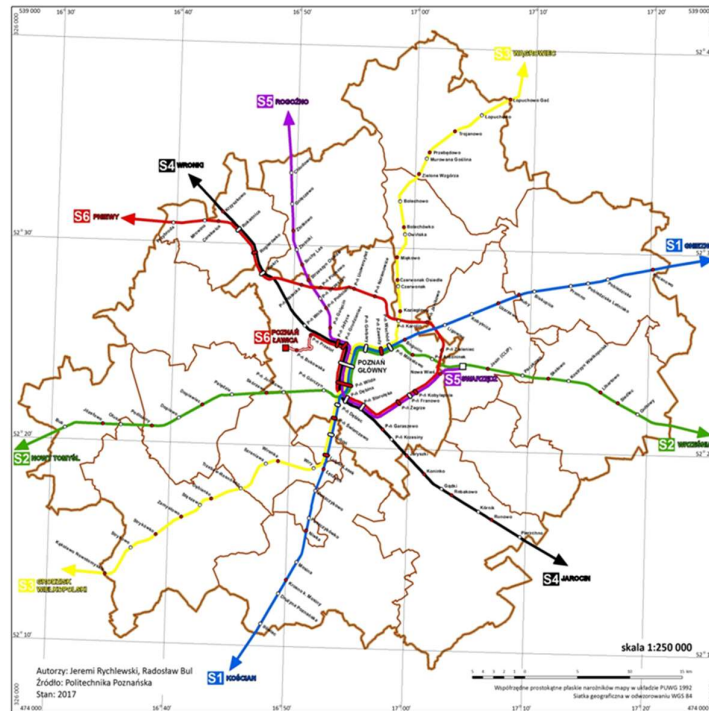
**Rail Line System**

Conceptual work on the shape of the Poznań Metropolitan Railway (PKM) has been ongoing for many years, involving a broad railway, academic, regional, and social community. Over this period, numerous discussions have taken place, and many study papers have been produced.

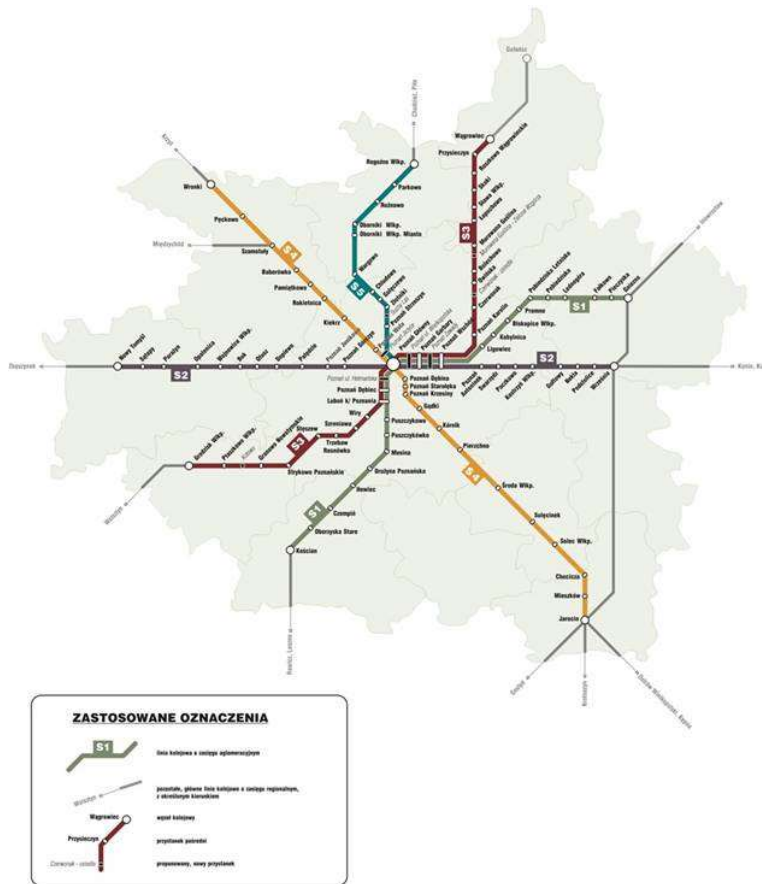
This article presents three selected PKM concepts (Fig. 1, 2, and 3), supplemented by the concept of the Poznań Ring Railway (PKO – Fig. 4), which most closely reflect the possibilities of technical and socio-economic utilization of railways in the Poznań Metropolitan Area (POM).

In the presented concepts one can observe many common features as well as certain differences in the concepts presented above. The arrangement of the first five routes remains constant in these concepts, apart from adjustments to routes S5 and S4—particularly where one of them ends (Poznań Główny Station, Swarzędz, or Września). This arrangement coincides with the currently implemented route system of the first stage of the PKM. The stability of these routes in the first stage results from:

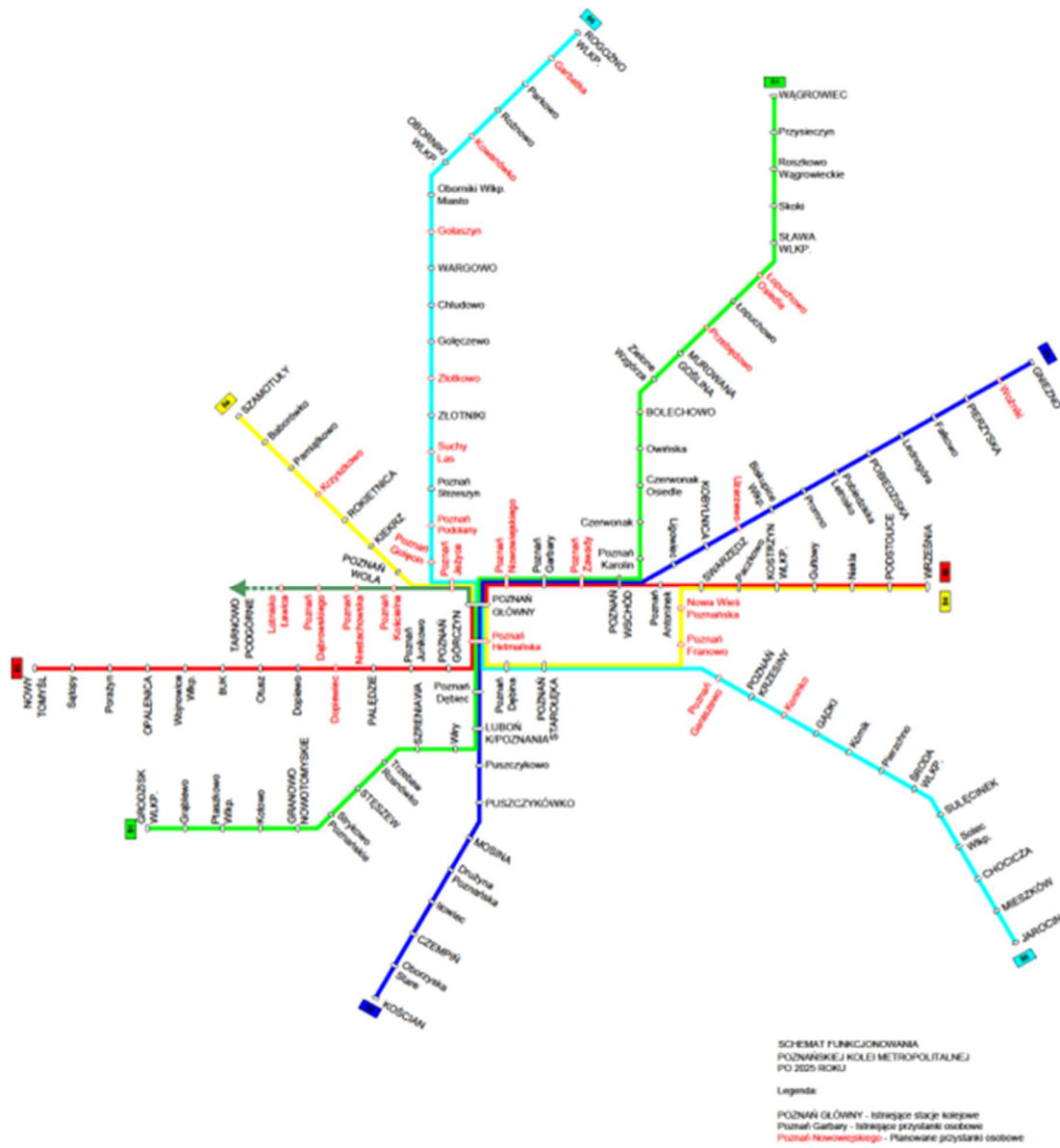
- Earlier discussions concerning the arrangement of several initial routes. These routes were originally proposed (without numbering and of shorter range) by the Wielkopolska Spatial Planning Office.
- Infrastructure limitations and transport potential:
  - Route S1 runs through areas with the greatest transport potential—only for this route and the PKO route is a target frequency of 20 or 15 minutes planned.
  - Route S3 is operated by the only two currently active non-electrified lines. Moreover, these are the only active single-track lines (a segment of route S4 from Wargowo to Rogoźno is also single-track) and are intended for speeds of 100–120 km/h (the remaining lines are intended for speeds of 140–160 km/h).



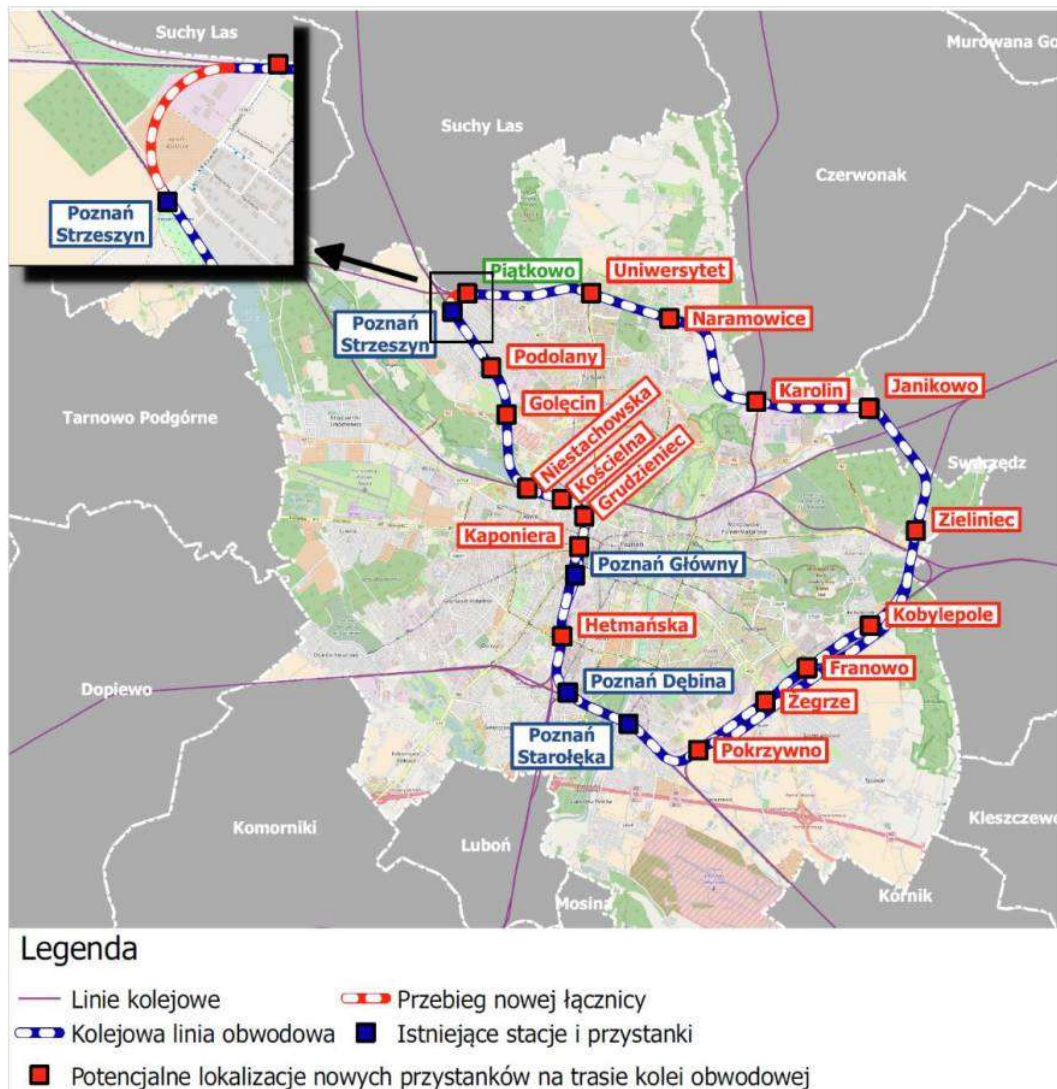
1. PKM route diagram according to the Centre for Metropolitan Research [1]



2. PKM route diagram according to TRAKO [2]



3. PKM route diagram according to WYG Consulting sp. z o.o. [3]



4. PKO route diagram according to BBF Sp. z o.o. [4]

In subsequent stages of PKM development, both an extension of long-distance reach by adding more municipalities and the launch of additional routes can be expected. Under the CBM concept (Fig. 1), Route S6 was introduced to serve Poznań's freight bypass line, the inactive line toward Pniewy, and the planned line to Poznań-Ławica Airport. After spatial analyses and a decision to forgo timetable synchronization at Poznań Główny Station, this route was replaced with the planned PKO route (still designated S6—Fig. 4). In addition, two new routes were proposed to terminate at Poznań Główny Station: S7 heading toward Pniewy and S8 to Ławica Airport and further on (as a modification of the CBM concept) to Tarnowo Podgórne. Another addition to the PKM system in subsequent stages is expected to be Route S9, connecting Czempień and Śrem, allowing passengers from Route S1 to transfer at Czempień Station.

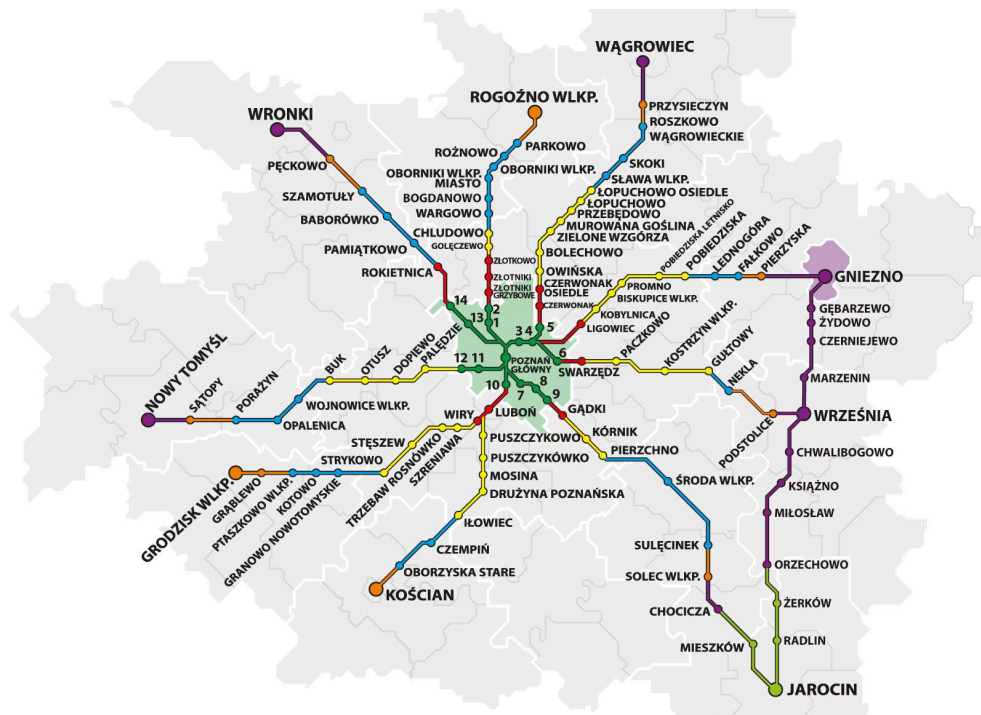
#### **A single ticket as a unifying element of different local government ticket tariff systems**

As evidenced by the experience of urban agglomerations in Western EU countries, a common ticket tariff that integrates different public transport operators can significantly increase the attractiveness of public transport and, consequently, attract more passengers to it. The benefits are tangible, as such a system substantially reduces road congestion, especially on city approaches.

Naturally, models for shared ticket tariffs can vary. For instance:

- They may be based on travel time — e.g., time tickets used on buses (and as an additional system on trams) in the Agglomeration.
- They may be directly distance-based — this system is used for railway tickets in Poland.
- They may be based on the number of stops — e.g., stop-based tickets used on buses and trams in the Agglomeration.
- They may be based on the number of zones crossed during a single journey — e.g., the so-called “honeycomb” system used in the German states of Berlin and Brandenburg.
- They may involve the introduction of ticket zones measured from the metropolitan center — this model has been in force for less than a year in the POM area (Fig. 5).

The fare model used in the POM for monthly tickets is based on implementing ticket zones radiating outward from the city. This ticket is valid for PKM travel and also for tram and bus travel within Zone A (the zone that includes the City of Poznań). Its appeal lies in the fact that passengers hold just one ticket valid on various modes of public transport, and the combined ticket price is lower by about 90–100 PLN compared to the total cost of separately purchased tickets for these services under the current fare system, depending on the zone.



5. Ticket zones of the Bus-Tram-Rail offer valid in the POM area [5]

The introduction of a common ticket for PKM and the public transport of the city of Poznań has significantly influenced passenger interest in using combined public transport. The next stage in the development of the offer is to include the so-called “third organizer,” which is the appropriate local government unit (JST) in the area where the passenger gets off the train and travels to their final destination. In this way, under a common ticket, a passenger could travel from the bus stop closest to their home to their destination in Poznań (and in fact – in any municipality within the POM). Work is also underway to introduce a Bus-Tram-Rail offer for single-use tickets and to change the ticket carrier to an electronic format. This change will make it possible to precisely determine passenger travel routes and obtain real-time information about



the occupancy levels of a given means of transport. This data, in turn, will enable a more accurate determination of the demand for public collective transport.

### Financing of the Metropolitan Railway

The concept of PKM's operation is based on the assumption that its legal organizer will be the Wielkopolskie Voivodeship, as is the case with the organization of regional rail passenger transport. The difference will be the co-financing of additional agglomeration trains by:

- the Wielkopolskie Voivodeship at the level of 40% of its costs,
- the municipalities (gminy) and counties (powiaty) located in the area of the future PKM operations, of which there are a total of 50.

These municipalities and counties will grant a targeted subsidy for this undertaking.

The entire co-financing concept is based on the principle of voluntariness, assuming a general understanding of the need to launch the PKM for residents who travel daily to Poznań (and also to the County) for work and school. The financing model assumes that the Wielkopolskie Voivodeship will launch and finance a guaranteed number of train pairs, while the subsidy from municipalities and counties will serve to increase the service frequency (i.e., increase the interval). It has been allowed that in the territory of municipalities that opt out of co-financing, the additional trains (those beyond those guaranteed by the Voivodeship) may not stop at stations or stops there.

Detailed calculations are presented in Tables 1 and 2. To calculate the volume of additional operational work, the routes of the future PKM and their lengths were compiled. Next, in a breakdown by railway lines, trains guaranteed by the Voivodeship and trains co-financed by three tiers of local government (the Voivodeship, counties, and municipalities) were calculated. From this comparison, it follows that the passenger transport work guaranteed by the Voivodeship is at the level of 5.5 million train-km, while the transport work envisaged for co-financing by JST amounts to just over 2.9 million train-km.

In Table 2, the cost of running an additional 10 pairs of trains is specified at PLN 58 million. At first glance, this amount appears high and may be difficult for local governments to bear. However, assuming that municipalities and counties (of which there are a total of 50) have to cover 60% of the cost of running the additional train pairs, the amount per single local government unit (JST) comes to PLN 698,000 per year. At this stage, without going into the details of how that amount would be allocated among individual municipalities and counties (taking into account, among other things, the size of the municipality, population, annual budget, etc.), it can be stated that the amount calculated above would be acceptable for individual JST.

**Tab. 1.** Total volume of operational work carried out in the POM area in the year.

PKM route no.	Length of section (km)	Operational work (train-km)		
		Guaranteed by the Province (38 courses)	Co-financed by 3 levels of local government (20 courses)	Total (58 courses)
S1 S	41,747	513 387,21	270 203,79	783 591,00
S1 N	50,358	619 282,07	325 937,93	945 220,00
S2 E	49,326	606 590,72	319 258,28	925 849,00
S2 W	57,385	705 696,69	371 419,31	1 077 116,00
S3 S	50,934	626 365,14	329 665,86	956 031,00
S3 N	57,034	701 380,41	369 147,59	1 070 528,00
S4 S	67,329	827 983,97	435 781,03	1 263 765,00
S4 N	42,515	522 832,17	275 174,83	798 007,00

S5	33,039	406 299,93	213 842,07	620 142,00
<b>Total (train-km):</b>		<b>5 529 818,31</b>	<b>2 910 430,69</b>	<b>8 440 250,00</b>

Source: Own study.

**Tab. 2.** Average cost breakdown per local government unit.

	Gminy i powiaty	Województwo
Rate for 1 train-km	20 zł	
	2 910 430,69 poc.-km	
Volume of transport work for 20 additional trains	58 208 613,80 zł	
Value of transport work for 20 additional trains	50	1
Number of local government units	60	40
Share in financing (%)	34 925 168,28	23 283 445,52
Share of all local government units	698 503,36	23 283 445,52

Source: Own study.

### Summary

The concept of the Poznań Metropolitan Railway (PKM) is based on using the nine railway lines radiating out from the Poznań Railway Junction, along with a combined Bus-Tram-Rail ticket. The layout of the railway network in the Poznań Metropolitan Area and the modernizations carried out in recent years have created favorable conditions for the launch of the proposed railway. It has been assumed that trains will be scheduled at 30-minute intervals (headway), and that the railway service will be provided by the carriers Koleje Wielkopolskie Sp. z o.o. and POLREGIO S.A.

Co-financing is based on the principle of voluntariness, which assumes a general understanding of the need to launch the PKM for residents who commute daily to Poznań (and also to the County) for work and school. The financing model assumes that the Wielkopolskie Voivodeship will launch and finance a guaranteed number of train pairs, while the subsidy from municipalities (gminy) and counties (powiaty) will serve to increase the frequency of service—i.e., to shorten the headway.

### Source materials

- [1] Studium uwarunkowań i kierunków zagospodarowania przestrzennego miasta Poznania, Uchwała nr LXXII/1137/VI/2014 Rady Miasta Poznania z dnia 23 września 2014 r.
- [2] Analiza zapotrzebowania na pasażerskie przewozy kolejowe w otoczeniu komunikacyjnym linii kolejowych w województwie wielkopolskim pod kątem zaspokojenia potrzeb przewozowych przez środki transportu, Tom IV. Koncepcja przewozów aglomeracyjnych Poznania jako elementu sieci kolei regionalnych województwa wielkopolskiego”, TRAKO, Wrocław 2010.
- [3] Koncepcja zintegrowanego transportu publicznego w oparciu o linie Poznańskiego Węzła Kolejowego, Etap I – Analiza istniejącej infrastruktury kolejowej pod kątem możliwości uruchomienia regularnych połączeń metropolitalnych (Poznańska Kolej Metropolitalna), ze wskazaniem zakresu niezbędnych inwestycji, WYG Consulting sp. z o.o., Warszawa 2014.
- [4] Opracowanie poszerzonej koncepcji pt. „Usprawnienie transportu kolejowego w aglomeracji poznańskiej poprzez uruchomienie szybkiej kolei miejskiej na obwodnicy towarowej Poznania”, Etap II – Proponowane rozwiązania i analiza przepustowości, BBF Sp. z o.o., Kwiecień 2017.
- [5] <http://bustramwajkolej.pl>.