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Proposal of city tram-train line for Wrocław

Abstract: In article short review of different types of present tram-train solutions working on world was made. Worked out till now proposals of tram-train lines for Wrocław were analysed. Proposal of new city tram-train line for Wrocław, connecting existing tram-loops Poświętne and Kromera, with utilization of railway line number 292 on section among stations Wrocław Sołtysowice and Wroclaw Osobowice, serving housing estates Poświętne and Karłowice, with possible branch to Sołtysowice was presented.

Keywords: Tram-train; Infrastructure; Kassel model

Introduction

In Wrocław, in years 2003 - 07, there was a decrease in transport by public transport from 255 to 193 million people a year, i.e. by almost 1/4 - in just four years! In turn, in the years 2007 - 12 there was an increase in the motorization rate from 441 to 540 cars per one thousand inhabitants, ie by about 1/5 - in only five years! As a result, transport problems occur today, in the form of loss of capacity of the road system, during periods of transport peaks.

Handling of passenger flows is currently carried out by trams and buses. Railway, despite the developed infrastructure, plays a marginal role. Looking for new solutions. For many years, new concepts have been developed based on rail transport: urban, agglomeration, regional, fast tram and even subway (although recently abandoned because of the result of the urban referendum). Some ideas have been implemented (tramway plus), others are still waiting for implementation - including a tram-train.

There are a number of different solutions based on this idea in the world. Until now, not all of them have been adapted to Wroclaw conditions. This article proposes a new way of using one of the known forms of a tram-train, in a new, previously unresolved location.

The genesis of the idea

One of the elements of the Wrocław Railway Junction is a secondary railway line number 292 (according to instructions Id-12), in relation Jelcz Miłoszyce - Wrocław Osobowice. The final section of it, with a connecting link connecting lines 143 to Oleśnica and 271 to Poznań, is over seven kilometers long connecting the stations Wr. Sołtysowice and Wr. Osobowice (photo 1) - single-track, with disassembled traction network, which occasionally passes freight trains.

In the vicinity of the intersection of the analyzed section of the railway line with Żmigrodzka Street (near the Marino shopping center) is the "Poświętne" tram terminus, where tram lines 1, 7 and 15 end. On the other hand, at some distance from the intersection of the analyzed section of the railway line with Sołtysowicka Street is the intermediate tram terminal "Kromera", where the tram lines terminate: 11 and 23, while line 6 continues to Kowal. From the "Kromer" loop towards Karłowice, leads Boya-Żeleński Street, over which the railway line 143 to Oleśnica is carried over. This viaduct is a "bottleneck", because only one lane is

under the railway track (there is a traffic light system installed there), and there are as many as 6 bus routes (A, 105, 116, 118, 130, 305). At the beginning of 2015, PKP PLK announced that it would modernize the Wrocław - Oleśnica railway line, under which the viaduct over Boy-Żeleński Street. Thus, there was the possibility of not only removing the said "bottleneck" but also to obtain something more, namely to build a new overpass in such a way that the tram line could also be underneath.

1. Railway line No. 292 on the section between the stations Wr. Sołtysowice and Wr. Osobowice

For many years the city has been planning a new tram line along Kamieński Street, from the intersection with Żmigrodzka Street, to the intersection with Kątowa Street. Unfortunately, less than 10 years ago, a thorough modernization of this street has been made, but without a new tramway track, and even without leaving a reserve for this purpose, one should not expect the soon-to-be-emergence of the mentioned line. It is also unfavorable that along with the modernization of Kamieński Street built a new bus loop for the line K and 144, but earlier than the end of the planned tram line - at the intersection with ul. Torowa, while two stops further (where only one, much less frequently operating bus route 130 is arriving), new multi-family residential buildings have been built for over a dozen years.

In the case of both considered tram loops: Poświętne and Kromera, in the current layout of the public transport line, we are dealing with the failure to use their potential. While 30 years ago all bus lines reaching the Kromer tram terminus from Psie Pole (102, 104, 130) and Kowal (118) - ended the route there, which ensured that the trolley line was already at their start, no line today the bus from these directions does not stop there, and some are heading to the center (N, 128, 904, 914), doubling the route of tram lines. In the case of the "Poświętne" tram terminal, although no bus lines coming from further suburbs ended the route there (thus bringing passengers to the trams), the fact is that there are such lines (129, 308 and 908) and that two of them are heading towards the center, doubling the route of tram lines. It is advisable, therefore, that the tram lines terminating the routes on both of these loops will be extended and will serve new destinations generated over the last dozen or so years, and there are several:

- new multi-family housing estates built on the grounds of former garden gardens or military units at Pleszewska, Kątowa, Falzmann, Czartoryski, and KoszarowaStreets,

- extended or new facilities of the University of Wroclaw at Daniłowski Square and at Koszarowa Street,
- hospital at Koszarowa Street,
- institutions (among others, the International College of Logistics) in "post-military" objects at Sołtysowicka Street,
- is still developing Sołtysowice estate.

The considerations presented so far prompted the author of this article to propose the construction of a new tram line connecting the existing loops: Poświętne and Kromera, using the railway line No. 292 on the section between railway crossings on Żmigrodzka and Sołtysowicka Streets, serving the housing estate: Poświętne and Karłowice, with the possibility of branching to Sołtysowice.

Tram-trains in the world

Tram-train system implemented so far in the world is characterized by a large variety. Phd Igor Gisterek in his article [1] proposed classification in the form of four basic models of this type of solutions:

1) taking over the railway line for the exclusive use of tram traffic,
2) time-separated mixed traffic of trams (during the day) and trains (at night) on railway tracks,
3) simultaneous mixed (alternating) traffic of trams and trains on railway tracks,
4) traffic of railway vehicles on tram tracks.

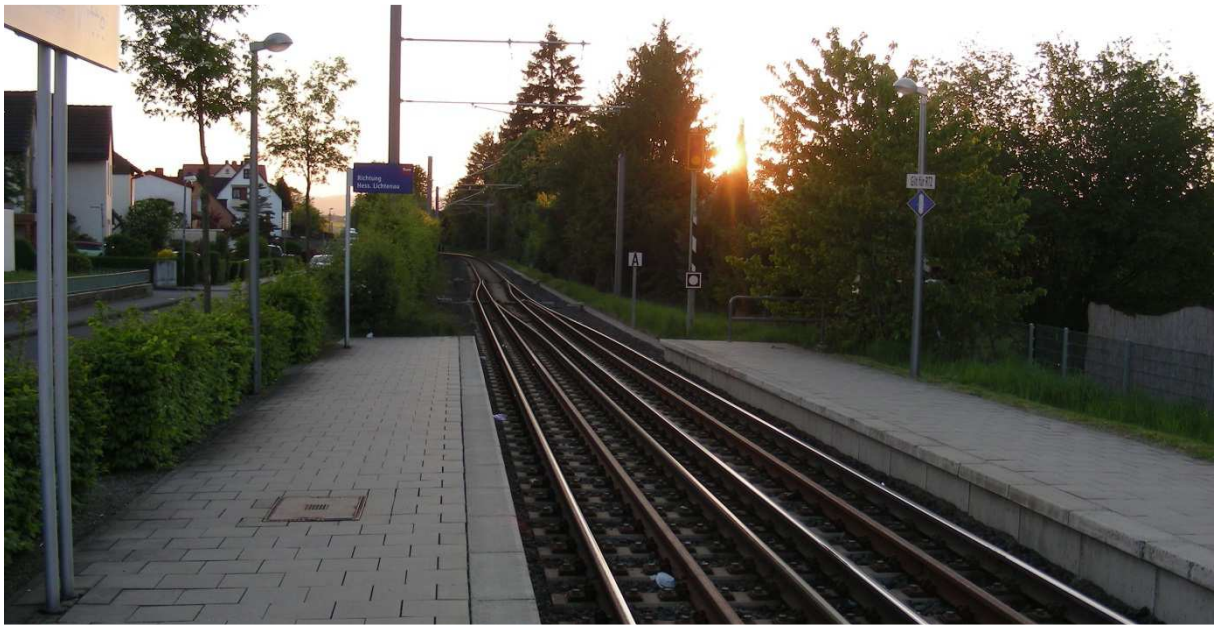
In Karlsruhe in 1958, the municipal transport company (VBK) took over the suburban railway line Albtalbahn to Bad Herrenalb and introduced trams running from the city center. Freight traffic was maintained only at night and only by traction. In 1979, the same company took over from the federal railways (DB) unprofitable section of the line to Neureut, electrified by tram voltage, added a loop at the end of the route and directed classic one-way streetcars. In 1989, this line to Hochstetten was extended. In 1992, the Karlsruhe Durlach - Bretten railway line was connected to the tram network and the operation of two-way streetcars adapted to both tram and rail tensions was started there. By 1997, this line had more than fivefold increase in the number of passengers! In the following years, subsequent railway lines were included in the same way into the system, leading to the creation of an extensive rail and tram network in this city. In 2013, 7 classic tram lines and 13 dual system buses were operated, including:

- one (S2) - with a single-voltage rolling stock, on the tram lines built in the footsteps of the old railway lines,
- two (S1 and S11) - with a single-voltage rolling stock, partly on the classical tram network, and partly on the AVG railway network with tram voltage,
- seven (S4, S41, S42, S5, S51, S52, S6) - with a double-voltage fleet, partly on the classical tram network (750 V DC), and partly on the railway network (15 kV AC),
- three (S31, S32, S9) - only on the railway network.

On some sections, tram-trains use the same tracks as ICE trains. Unfortunately, the solution fell victim to their own success - trams began to get stuck in traffic jams. Currently, in the city center, parallel to the busiest sections of the network, tunnels are being built to which two-system trams will be introduced.

In Kassel, from 1995, tram 5 began to commute to Baunatal-Grossenritte using the new section of the classic two-track tram line (2.2 km), and further from the section of the single-track railway line (3.3 km) to Naumberg, where passenger traffic it was suspended in 1977. This section was electrified by tram voltage, the geometry of crossroads of turnouts was adapted to the profiles of tram wheels, new passes, ties, stops and a loop were added at the

end of the route. The route 4 tramways was extended in a similar way: in 1998 to Kaufungen Papierfabrik, in 2001 - to Helsa, and in 2006 - to Hessisch Lichtenau, using for this purpose a single-track railway line to Waldkapel, running since 1985 exclusively freight traffic. It was also here that electrification by tram voltage, adjusting the geometry of the crosstalk, built was passed, strands (pic.2) and loops, and in certain sections (in Kaufungen and Hessisch Lichtenau) completely new sections of tram lines were built, better penetrating built-up areas than the line used railway.



2. Weave track at the Niederkaufungen Mitte stop on the tram route line 4 from Kassel to Hessisch Lichtenau (pic. Igor Gisterek)

In 2001, the railway network at the main station in Kassel received a tunnel connection to the tram network, which allowed the commencement of the operation of two-way streetcars adapted to both tram and railway tensions under the RegioTram brand on the Warburg route as RT3 line (currently RT1). In 2006, the RT5 to Malsungen line was opened, while in 2007 - RT9 to Schwalmstadt-Treys (this line ended the route at the railway station and did not enter the classical tram network, and from December 2015 it was replaced by regional trains). In 2006, the RT4 line was also commissioned with non-electrified tracks to Wolfhagen, using a hybrid fleet (electric-combustion trams). Previously, for several months, the hybrid fleet served a temporary RT2 line to Hessisch-Lichtenau before classic tramway 4 commutes began.

In Saarbrucken, the classic tram was liquidated in 1965. In 1997, a two-system tram line was launched from the Sarreguemines situated on the other side of the border (with France). First, trams crossed the section of the federal railway line (13 km), and then they drove onto the newly built tram route (5 km), but with railway parameters leading through the city center (to the railway station). In subsequent years, the route was extended northwards: first through the city streets (to Siedlerheim in 2000), then along the A1 motorway (to Riegelsberg in 2001), then again through the streets of the village (to Walpershofen in 2009), and on end - the railway line (to Heusweiler Markt in 2011 and Lebach in 2014).

In Zwickau, the main railway station is located some distance from the city center, which is why since 1999 some of the trains served by combustion busses have entered the tram network. The rail buses first use the track of an old siding circling the city center from the south, reach the new shopping and entertainment center (Stadthalle), where they enter the

reconstructed tram track, which reaches the bus stop in the center. Tracks on the rail-tram section have three rails (trams in Zwickau are narrow-gauge) and an enlarged wheelbase (buses are wider than trams). Railcars on the common section do not stop at tram stops, and at the end stop in the center have a separate platform (buses are unlike trams are high-floor). Railcars have been adapted to traffic (lighting, turn signals).

In Chemnitz in 2002, a track connection was made between the classic tram (Altchemnitz) located on the outskirts of the city and the railway line running alongside it, which allowed the launch of the new 522 tramtrains to Stollberg (now marked as C11). These trams are two-way, low-floor, slightly wider than the classic ones (2.65 m instead of 2.4 m), an intermediate rim profile was used in them (wider bandage, higher rim, larger diameter, contact for the steering wheel). The railway line was electrified with a voltage slightly higher than in trams (750 V instead of 600 V), the platforms were rebuilt to low, in the switches, mobile crossbows and increased crossings were used, railway crossings were rebuilt (heated rails were used). In 2009-13, the tram loop was reconstructed in front of the main station, as a result of which a tram stop was created in the station hall (parallel to the railway platforms), connected to railway tracks. This solution first only facilitated changes between trains and trams until autumn 2016 when three new lines of the two-system tram were started, going down from the tram tracks to the railways: C13 to Burgstadt, C14 to Mittweida and C15 to Hainichen.

Nordhausen has a small narrow-gauge railway network (only two lines) and a narrow-gauge railway Harzer Schmalspurbahnen (HSB). In 2002, a track connecting the tram stop in front of the main railway station was started, with a narrow-gauge railway station located next to it, thanks to which the HSB railway bus buses started commuting to the tram stop, making it easier for travelers to transfer. In 2004, two-way hybrid trams (electric-exhausted) Siemens Combino Duo were put into operation, which allowed the launch of the 10-tram double-tram line to the nearby Ilfeld.

On the north-eastern suburbs of Paris, between the stops B and E of the RER agglomeration, a tramway T4, called the two-system tram, was launched in 2006, as this line uses a fragment of Coquetiers closed in 2003. However, this line does not use the sections common to the normal railway traffic, nor from sections that carry the movement of classic trams. The operator is the railway carrier (SNCF), not urban. A new 6-km east leg is currently being built from the middle station of the existing line (Gargan) to the Montfermeil hospital team.

Between the Hague and Zoetermeer, a few kilometers away, there was an access queue operated by the national rail carrier (NS). The trains only reached the central station of The Hague and did not penetrate the city center. A decision was made to convert this line to a two-system tram, which became part of the project called "RandstadRail". The rest of it is to convert one of the two railway lines connecting The Hague to Rotterdam - less important (Hofpleinlijn) to the subway (currently line E). In Zoetermeer, on the former access line (in the form of a loop around the town), several new stops were built, an extension of the line was added (2.5 km), thanks to which trams better penetrate the served area than the railway. Another extension (Javalaan - Bleizo) is currently under construction. On the entire line, the platforms were reduced to 30 cm, and the voltage in the traction network was reduced from 1.5 kV to 750 V. In The Hague a link was built between the railway and tram network in the form of a flyover, with an attractive openwork housing (with a grid structure) a section in the center - several kilometers long tunnel (so that two-system trams do not "get stuck" in traffic jams). In 2006, two lines of the two-system tram were launched on this route (currently 3 and 4). In 2009, 38 thousand of them used them passengers, compared to 18 thousand in 2002, when the connection served the railway. Since 2007, the metro trains from Rotterdam have been running along a several-kilometer-long section of the two-system tram line. At five joint

stops, the platforms are partly long and parts low. There was no problem with the power supply - both the metro and the dual-system tram on the common stretch use the upper network and voltage of 750 V.

In Mulhouse, trams were liquidated in 1957. They were revived in 2006 in the form of a modest network that initially operated only two, and since 2010 - three tram lines. At the end of the third line (in Lutterbach) a transition from the tramway network to the railway was made, which allowed for the launch of a train-tram line to Thann. The operator is the railway carrier (SNCF), not urban one.

Current proposals for a two-system tram line for Wroclaw

The term "two-system tram" in the documents concerning the formation of the Wrocław transport system appeared for the first time in 1996, in the study prepared by the Polish Ecological Club and the Board of Roads and Communication [7]. In the chapter entitled "Possibilities of system improvements", the section "Full integration of track infrastructure in the Wrocław agglomeration" appeared: "some of the tracks are currently out of service or used sporadically, therefore it is possible to run two-system trams on them". However, the study did not specify anything more about it.

In the transport policy of Wrocław adopted in 1999, the two-system tram has not been mentioned even once.During the conference "Integrated Municipal Rail Transport System" organized in 2003 by the Wrocław University of Technology, PhD Maciej Kruszyna proposed the launch of the dual-system tram line [5] in the following relations:

- from the tram terminal at Robotnicza Street by rail: 275 towards Śróda Śl. and 273 towards Wołowa,
- from the Kromer tram loop with railway lines 143 and 326 to Trzebnica,
- from the Park. Pd. tram loop. railway line 285 to Sobótka.

On the next of this conference series (in 2005), PhD Kruszyna presented the concept of a pilot dual-system tram line for Wrocław [4], on the route from Leśnica with railway line 275 to the tram loop at Robotnicza Street, and then tram routes through the streets: Legnicka, Kazimierza Wielkiego (alternatively the new Robotnicza, Piłsudskiego, Kołłątaja), Piaskowa, Poniatowskiego, to the Kromer tram loop, and then the railway line 143 to Psie Pole.

In the publication of the Wrocław University of Science and Polbus in 2004 entitled "City of Wrocław - Space of communication and transport", the concept of the Wrocław Municipal Railway by Jacek Jerczyński and Ryszard Boduszka [3] was described, using the idea of a two-system tram. In this concept, it was proposed to make connections between the tram and rail network in the following places:

- Małachowski Street - Wrocław Towarowy main station,
- Orląt Lwowskich Squre - Wrocław Świebodzki station,
- Robotnicza Street- Wrocław Gądów freight station,
- Kromera Street - Wrocław Sołtysowice station,
- Żmigrodzka Street- the railway line 292 crossing it.

The authors also proposed that the planned construction of the east bridge route (Wielka Wyspa avenue) should take into account the line of the two-system tram from Wilczy Kąta to Swojczyce or Kowal, and in the long run to Zgorzelisko and Psie Pole. A similarly planned new course of Robotnicza Street (between Orląt Lwowskich Square and Śrubowa Street) should provide for running the two-system tram line there.In the study of conditions and directions of spatial development of Wroclaw, adopted in July 2006, seven locations of connections between the tram network and railway lines were proposed in the figure depicting public transport:

- Poświętne tram loop - railway line 292 (between stations: Wr. Sołtysowice and Wr. Osobowice),
- planned tram loop at the railway station Wr. Psie Pole - railway line 326 to Trzebnica,
- Kowale tram terminal - railway line 292 to Jelcz-Miłoszyce,
- planned new tram line through Swojczyckie bridges - railway line 292 to Jelcz-Miłoszyce,
- planned tram line along Borowska Street- railway line 285 to Świdnica,
- planned tram line along Gołąstowa Street- railway line 285 to Świdnica,
- planned tram line along Robotnicza Street (near the Orląt Lwowskich square) - railway line 274 to Jelenia Góra.

In the autumn of 2006 prepared by the Municipal Office of the "Integrated rail transport system in Wrocław and the Wrocław agglomeration" developed in connection with the intention to launch tram lines with increased parameters, "Tram Plus" was assumed: "It is not excluded to take the Tram Plus line beyond the boundaries of Wroclaw (a few kilometers), using existing railway tracks (not currently used for passenger transport)".

Developed in 2007 at the request of the Municipal Office "General plan of railway transport development in Wroclaw" did not provide solutions in the form of a two-system tram, except for the proposal to build a new tram line on the track of the then unused railway line 326 to Trzebnica, but only on the section from Irkucka Street to the city border.

The next Study of Conditions and Directions of Spatial Development of Wrocław, adopted in 2010, on the issue of two-system trams repeated the findings of the previous study of 2006.

During the conference "Integrated urban transport system" organized in 2010 by the Wrocław University of Technology Patryk Wild from the Wrocław MPK presented the concept of Wrocław Metropolitan Railway [8], under which the following three lines of the two-system tram would be launched by 2015:

- MT2 - from the station Wr. Leśnica by railway line through Wr. Żerniki and Wr. Nowy Dwór to Robotnicza Street, then tram routes through the streets: Legnicka, Kazimierza Wielkiego, Traugutta to Krakowska Street, from where the railway line through Wr. Brochów to Siechnica,
- MT4 - from the station Wr. Pracze on the railway through Wr. Kuźniki to Robotnicza Street, then tram routes through the streets: Legnicka, Kazimierza Wielkiego, Społeczny Square, the Reagan roundabout to the tram terminal at the Olympic Stadium, and in the future (until 2025), newly built sections of tram and rail lines to Psie Pole, from where the railway line 326 to the station Wr. Zakrzów,
- MT6 - from Kobierzów railway line to Karkonoska Street, then the route of the tram line 7 to the Poświętne tram loop, from where the railway lines 292 and 271 to Oborniki Śl.

In this concept, it was proposed to make connections between the tram and rail network in the following places:

- Robotnicza Street- railway junction 753 (Wr. Grabiszyn - Wr. Gądów),
- intersection of Krakowska and Kościuszki Street - the tracks of the Wr. Głowa Towarowa,
- Ołbińska Street - the tracks of the Wr. Nadodrze,
- Żmigrodzka Street - railway line 292 crossing it,
- Klecina tram terminal - Wr. Klecina on the 285 railway line.

In 2012 during the Tram Investment Forum Wojciech Zdanowski from the Wrocław MPK presented the concept of a two-system tram called "MeTram", which is a modification of the previously described Patryk Wild's proposal, in which the MT2 line was marked as 3+, line

MT4 - as 21+ and from the Reagan roundabout directed to Biskupin, while the MT6 line - as 7+.

In 2012, Wroclaw University of Technology, at the request of Wrocław MPK, prepared a study entitled "Analysis of technical issues related to the commissioning of a two-system tram in Wrocław" [6]. The aim of the study was to formulate technical conditions that should be met by rolling stock, route delineation and the indication of necessary modifications and adjustments within the track and trackside infrastructure. The study proposes to make connections between the tram and rail network in the following places:

- intersection of Krakowska and Kościuszki Streets - the tracks of the Wr. Głowa Towarowa,
- Krakowska Street - a siding crossing it to the former Pollen plants,
- Bardzka Street - railway line crossing it 285,
- tram terminal Park Pd. - railway line 285, through Ołtaszyńska or Gołąstowa Streets,
- Klecina tram loop - Wr. Klecina on the 285 railway line, through Kobierzycka Street,
- Kwidzyńska Street - siding on the premises of the 3M plant (leading to the station Wr. Swojczyce on the 292 railway line),
- Robotnicza Street - railway junction 753 (Wr. Grabiszyn - Wr. Gądów),
- Ołbińska Street - the tracks of the Wr. Nadodrze,
- Żmigrodzka Street - railway line 292 crossing it.

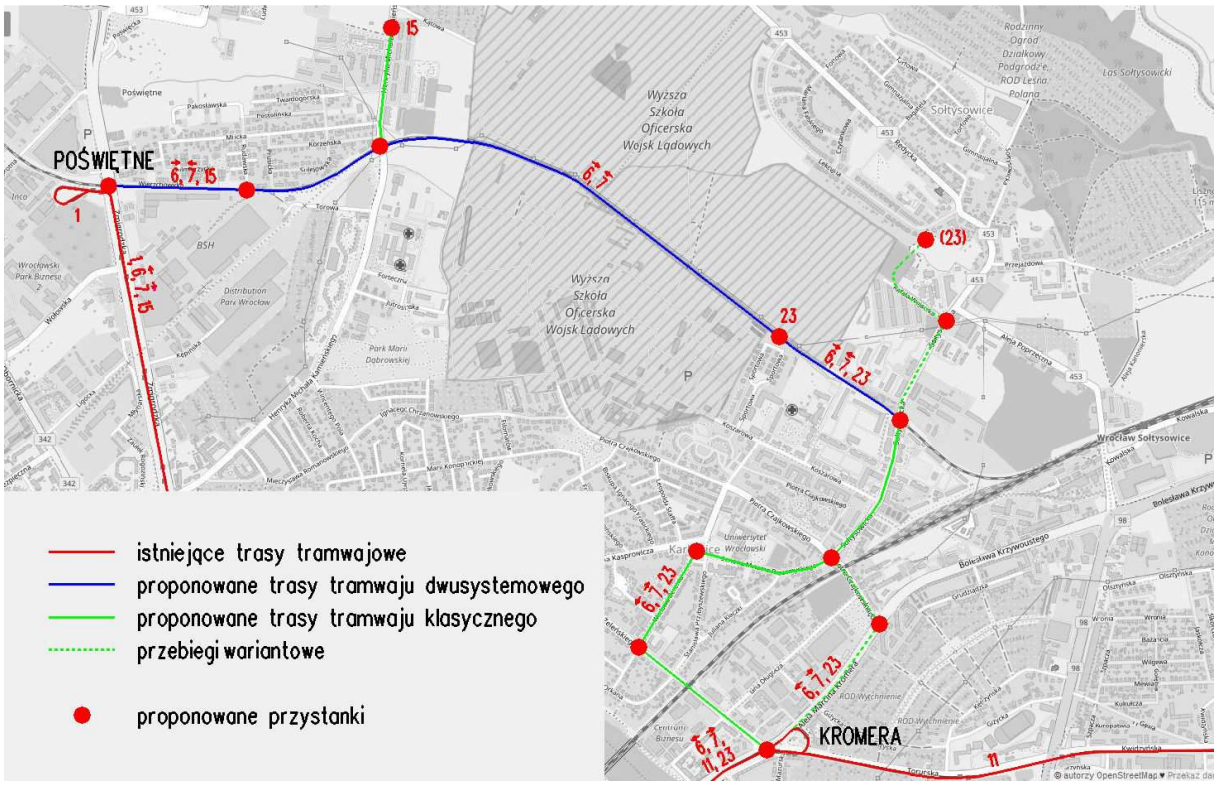
The study concludes that only some railway lines leaving the Wrocław's railway junction are suitable for the introduction of two-system trams. This is conditioned by two factors:

- distribution and density of the settlement network (ability to generate adequate vehicle fillings, appropriate inter-particle spacing),
- geometric and motor parameters (lines of higher categories are predisposed for handling aglo or regio).

In the study, as the most suitable for using two-system trams, the railway line 285 Wrocław-Świdnica was recommended, with the connection to the tram network at the extension of Bardo Street. The final conclusions draw attention to difficulties in the case of homologation of non-standard rolling stock, lack of national regulations and norms, proposing as a more favorable maintenance of the distribution of trams from railways, however, with the exception of solutions in the form of taking over or disabling a railway line for the needs of a tram separated in time.In the mobility policy in Wroclaw adopted in 2013, no two-system tram has ever been mentioned.

Description of the proposed solution

The basis of the presented idea of the new two-system tram line is the use of railway line No. 292 on the section between railway crossings at the intersections with Żmigrodzka St. (from the west side) and Sołtysowicka St. from the east (picture 3).



3. A proposal for a new two-system tram line (in the background it was used [2])

At Żmigrodzka Street tram line runs right next to the railway tracks, making a link between the railway and tram network in this place should not be a problem. The situation looks completely different at the other end of the used section of the railway line. Railway crossing at Sołtysowicka Street is located about 2 kilometers from the nearest tram terminus at Kromer Street. At this point, it is necessary to build a section of a classic tram line. In the basic variant, the author proposes to run it through the streets of Boya-Żeleński (under the rebuilt viaduct of the railway line 143), Berenta, Przesmycki and Sołtysowicka. Admittedly, the Streets of Berant and Przesmycki are narrow and built-up with single-family houses, however, in the world tram transport is introduced into areas of a similar type, which can be a good example:

- completed in 2007 extension of line 6 to St. Peter in Graz,
- the 26th line launched in 2013 in the new route through the Hirschstetten housing estate in Vienna.

In both cases, trams were run together with circular traffic, streets of traffic zones with a 1 + 1 cross-section, sometimes with a pedestrian sidewalk only on one side of the street. However, if at the stage of social consultations it turned out that the residents of Karłowice did not want the trams "under their windows", the author proposed an alternative route through Kromera and Czajkowskiego Streets, where unfortunately there is an intersection with the railway line 143, currently functioning as a guarded railway crossing. Therefore, it is necessary to build a viaduct or tunnel, tram or streetcar on this spot. An alternative solution does not penetrate the Karłowice housing estate anymore, it bypasses an important travel generator which is Daniłowski Square (due to the nearby facilities of the University of Wroclaw), also will not relieve the bus communication operating in this area.

The next section of the classic tram line on the basis of the "reach" terminated with a loop or a stop, the author proposes to build between the railway crossing at Kamieńskiego Street and the area of the intersection of this street with Kątowa. For the last few years, multi-family housing has been intensively developing there.A similar "reach" could be implemented

from the railway crossing on Sołtysowicka Street in the area of Lekcyjna Street in Sołtysowice (in the vicinity of plot No. 10), although here the need is smaller, because it is a single-family housing area, and again such a solution would not please the residents. As an alternative, in such a case, one could predict a loop or a limit in the area of Sportowa Street, where the generator of the trip, apart from the surrounding buildings, would be a nearby hospital.

For the proposed infrastructure solutions, the author predicted the following organization of the tram traffic:

- to the loop or limitations at Kątowa Streetcould be extended by line 15,
- to the loop or limitations at Sport Street or Lekcyjna Street could be extended by line 23,
- the whole section of the proposed line between the "Poświętne" and "Kromera" loops could run in opposite directions lines 6 and 7, similarly as at present lines 14 and 24 in the "triangle" of Grabiszyńska - Hallera - Powstańców Śląskiego Streets, which would require a return to solutions from a dozen or so years ago, namely the lines 11 to Kowal, instead of the current line 6.

Such an unusual solution - with two lines running in opposite directions in the "triangle" of the streets (instead of the classic two-way routes terminated with loops or limiters) has its advantages, for example, let residents of Karłowice quickly reach the Marino shopping center, and residents of Poświętny - quickly reach the hospital or universities located in Karłowice.

Summary

Presented in the article, the proposal for a new tram-train line for Wrocław was inspired by the solutions used for the first tram and railway lines first launched in Karlsruhe (to Bad Herrenalb and Neureut), and later in Kassel (to Baunatal and Hessisch Lichtenau), where on railway lines from small commodity traffic (after limiting it to night hours), classic one-way streetcars were introduced. In this way, the need to buy around twice as expensive rolling stock was avoided, when there was no need to change the voltage and to obtain a "railway" crashworthiness of vehicles.A novelty in the presented solution is the fact that the proposed new line of the two-system tram does not leave the city limits, therefore the title of the article uses the term "city line".

The proposed solution can be implemented in stages. In the first place, it would be most convenient to reach by rail transport to the area of the new multi-family housing estates at Pleszewska, Falzmann and Kątowa Streets. A section of the 292 railway line from Żmigrodzka Street to Kamieńskiego and then the classic tram line along Kamieńskiego Street. In the second stage (after the reconstruction of the viaduct of the railway line 143 above Boya-Żeleńskiego Street), it would be possible to build a classic tram line through Karłowice, to cross the railway on Sołtysowicka Street, and then a section of the 292 railway line to the terminus or terminus at Sportowa Street. With the final "closure" of the proposed route in the form of the use of the section of railway line 292 between Kamieńskiego and Sportowa Streets, you can wait until a possible change of land development on both sides of this route. Currently there is the Higher Officer School of Land Forces located there, but in the history of Wrocław's development, the army has already returned to the city several times and moved into less urbanized spaces.

An obstacle in the implementation of the proposed solution may be the fact that the analyzed section of the 292 railway line, according to the concept prepared by the Lower Silesian Marshall Office in 2009, is planned to be used within the framework of the Lower Silesian Commuter Railway (DKD). In the variant assuming the commissioning of 14 new lines, the analyzed section of the 292 railway line is planned for two of them: D10 (Brochów-Wojnów) and D11 (Leśnica-Sobieskiego) and the construction of four new stops:

Uniwersytet, Artyleryjska, Kamieńskiego, Poświętne. However, it should be noted that the concept of the Marshal Office is overly expanded, other ideas assuming the launch of the agglomeration railway in Wrocław, do not envisage the use of the analyzed section of the railway line 292. Even if the local authorities could implement the DKD concept to the full extent, examples of some solutions from abroad (e.g. The Hague) show that the two-system tram does not exclude running the same sections of the city railway.
The solution proposed in the article is a general idea requiring more detailed analyzes. Refinements require issues such as:

- transitional sections between the tram and railway network,
- location of stops and passages,
- location of the tram track in cross-sections of streets (on the lengths of sections of classic tram lines),
- gauge problems in the case of stops along the railway line (track links or other possible solutions),
- use of loops or limit switches,
- turnouts (crosses) - and the profile of the tram wheel,
- re-electrification of the railway line, but under the tram voltage,
- traffic control.

These problems are included in master's theses, which the author of this article has prepared and suggests to students of the specialties of the Rail Transport Infrastructure at the Wrocław University of Technology.

Source materials

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