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How to terminate the Bielany Interchange

Abstract: The article discusses the design of road interchanges in terms of their layout, expansion and location in the road network. As a case study, the "Bielany Wrocławskie" interchange was analyzed on the A4 motorway and the southern inlet to Wrocław. Present state was presented (including current renovation) against the history of construction and transformations of this object. Spatial and movement conditions are shown. After analyzing these elements, the author asks about the future of the interchange. Will the most functional solution be further reconstruction or liquidation of the node in this location? The analyzes may be used in shaping the network of rapid traffic routes in other locations than analyzed in the article.

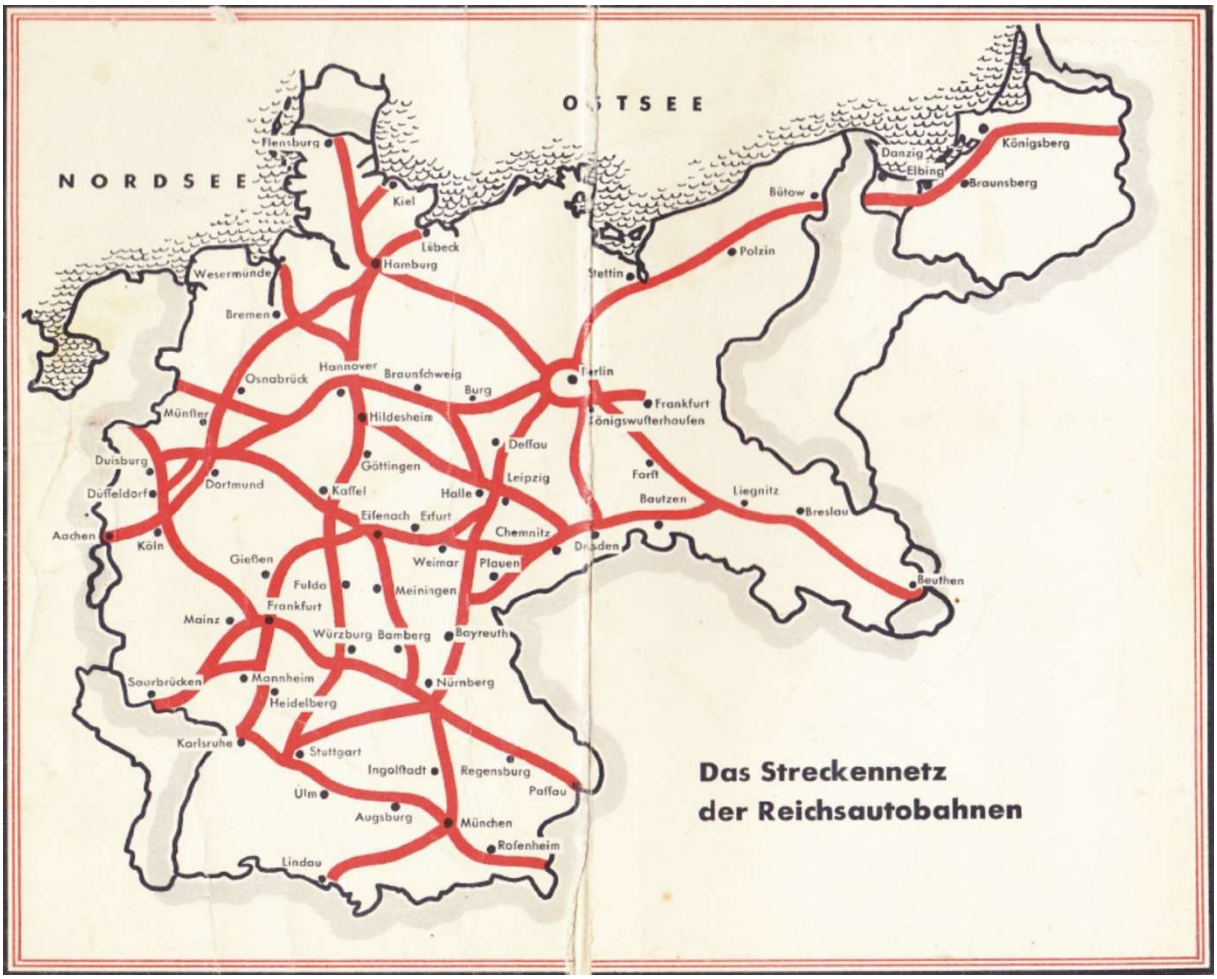
Keywords: Road interchanges; A4 motorway; Bielany Wroclawskie

Introduction

The possibility of using one of the classic road node schemes (clover, turbine, Maltese knot, trumpet, etc.) verifies the local situation. In addition to spatial conditions (functions and angles of crossed roads, accessibility, and terrain), traffic conditions are important (or should be), and above all predicted intensities and directions of traffic flows. In the case of forecasting traffic distribution, it is important to be aware of the future (and the target) road network in the vicinity of the considered node, because the implementation of new routes and nodes in the future may result in a significant redistribution of traffic. In other words, the current state at the time of designing the node may change, in the context of increasing traffic (and sometimes decrease), especially in relation to specific relationships. If switches are formed without the possibility of their expansion, in the future one should consider a significant modification of the node's scheme and costly reconstruction. In extreme cases, the most drastic solution is to liquidate the node in its original form and build a new facility closer or further to the current one. The conditions described above relate to the Bielany interchange (Bielany Wrocławskie) at the southern inlet from the A4 motorway to Wrocław. So this is the "case study" node described in this article.

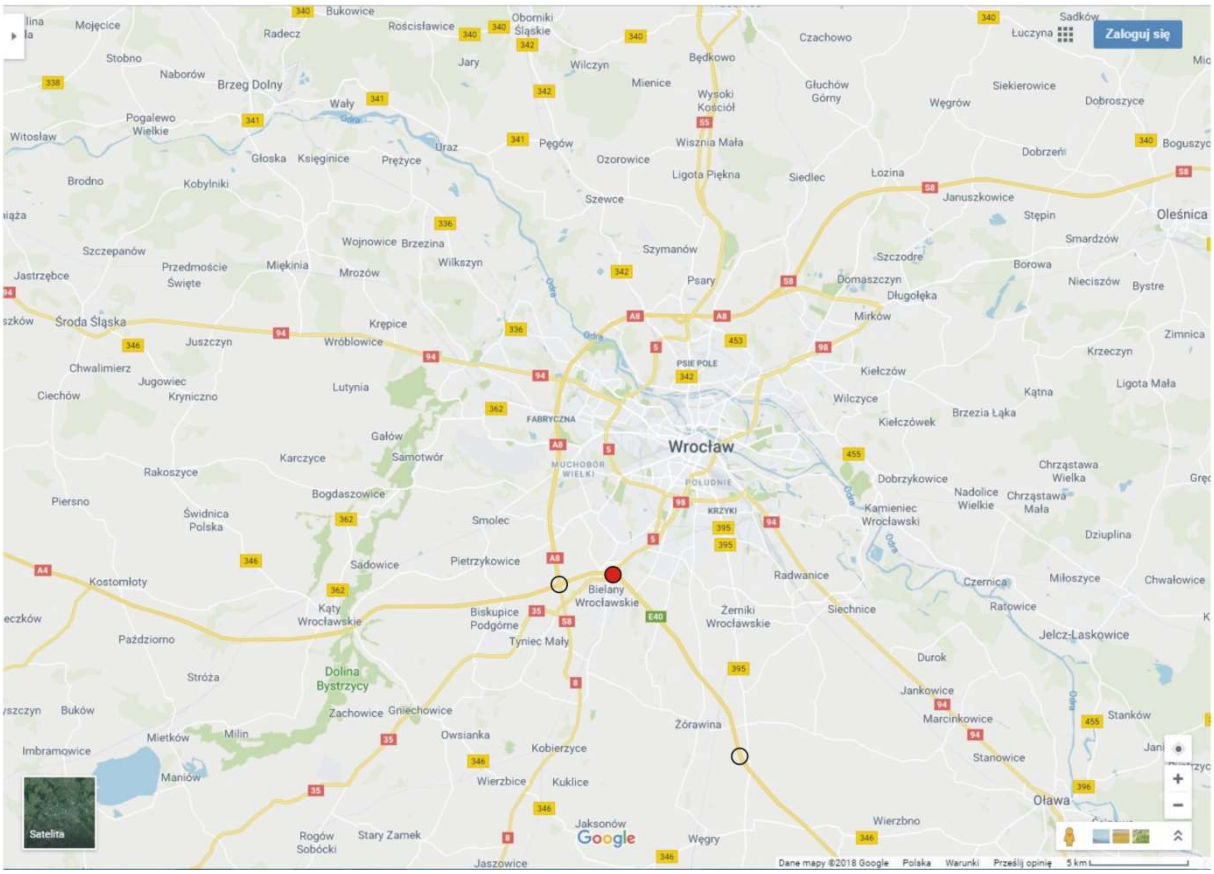
The history and current state of the interchange

The "Bielany Wrocławskie" interchange was created with the launch of the first sections of the A4 motorway before the Second World War. The history of the construction of this motorway brings the article [1]. We read in it that: sections of contemporary A4 were included in the plans to create a network of highways drawn up by the authorities of Nazi Germany. Their construction was an element of state intervention and war preparations, in which the use of modern roads for the rapid transfer of troops was assumed. The planned network of motorways of the Third Reich is shown in Figure 1.



1. Map of planned motorway network III. Reich (scan from BZ Atlas atlas issued around 1933)

In 1934-1943, dual carriageways were created: Krzyżowa - Wrocław (99 km) and single carriageways Wrocław - Brzeg (about 41 km) and Nogowczyce - Gliwice (about 37 km) [1]. They were marked as RAB 9 Berlin - Breslau (section Berlin - Wrocław) and (German) RAB 29 Breslau - Oppeln - Gleiwitz - Beuthen (section Wrocław - Opole - Gliwice - Bytom). The Bielany Wrocławskie interchange, in its initial form, had a half-bay scheme. Entrances and exits from the motorway were collision-free and intersections were made on the intersection with the motorway. In the nineties of the twentieth. In the century additional bridges were added, transforming the knot into a full clover, although without the normative lengths of some switchboards and switch-on and switch-off belts. The location of the node on the background of the surrounding road network is shown in map 2, and the current scheme is picture 3.



2. Location of the Bielany interchange on the background of the surrounding road network (based on the map https://www.google.com/maps)

3. The current scheme of the Bielany interchange (based on the photo https://www.google.com/maps)

It is worth recalling [1] that the construction of the entire A4 motorway lasted from March 21, 1934, when work was started between Legnica and Wrocław, until July 20, 2016, when the construction of the section from Rzeszów to Jarosław was completed. The construction of the main road from the border with Germany to the border with Ukraine took place under conditions of great political and economic changes in the areas through which its corridor passes. Until 1945, it was built as a German autobahn connecting Berlin with Upper Silesia. After the war, already within the borders of Poland, it was initially created as a combination of Lower and Upper Silesia with Kraków, and then as the southern transit route between Germany and Ukraine. The final course of the motorway was strongly associated with political changes in Europe after 1989, and especially with Poland's accession to the European Union. The decisive influence on the acceleration of investments at the turn of the 20th and 21st centuries was determined by the establishment of pan-European transport corridors and the inflow of Polish road engineering with EU funds.

The size of traffic on the interchange and its structure and distribution is influenced not only by the location in the suburban area of Wroclaw (one of the main entrances to the agglomeration center) but also the vicinity of large commercial and production facilities implemented since the 1990s. century and constantly enlarged (eg new Amazon halls). On the basis of the information from [6], we identify in the immediate vicinity of the road Bielany node a large complex of large-area stores and the largest shopping center "Aleja Bielany" in Poland. Nearby there are factories, two logistic centers and technology parks with a total area of over 240,000. m². In addition, there is another shopping center on the north side of the A4 motorway.

The movement situation near the Bielany interchange changed the construction of the Wrocław Motorway Bypass (opening in 2010) and its connection with the A4 motorway with the Wrocław South interchange located a short distance west of the interchange under consideration.

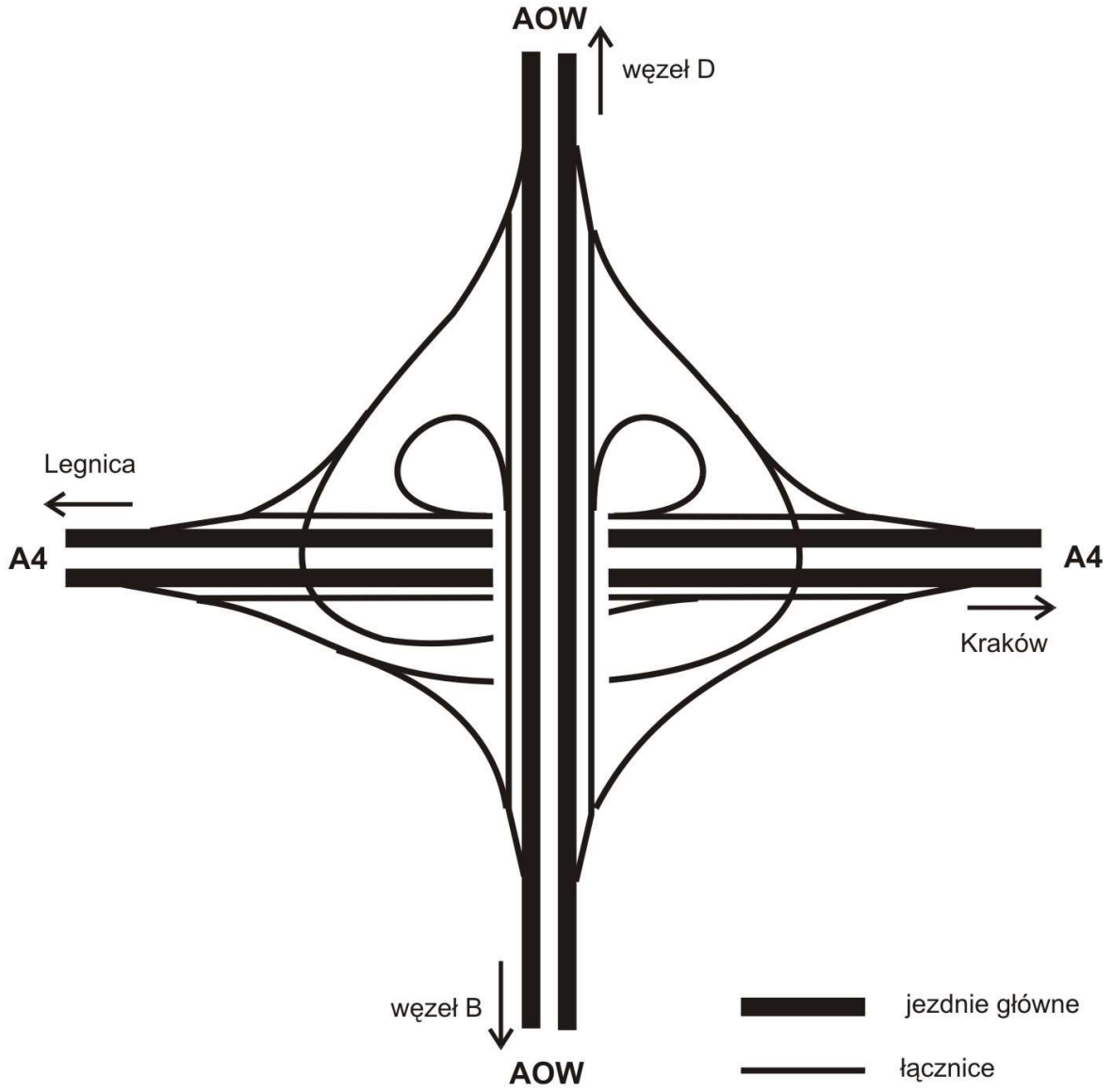
The situation at the Bielany interchange in the light of technical requirements and volume of traffic

The regulations governing design principles [5] and taking into account the specificity of motorway traffic formulate the requirements for the location of nodes. Paragraph 9.1 of the Regulation [5] gives the permitted spacing between nodes or intersections and the conditions for the use of exits to ensure the required level of road safety. The class A route should have connections with G-class roads and higher-class roads, and the intervals between nodes should not be less than 15 km, and within the limits or vicinity of a large city or a group of cities - not less than 5 km. It is allowed exceptionally single spaces of no less than 5 km, and within the boundaries of or adjacent to a large city or a group of cities - not less than 3 km, if functional and operational needs such intervals justify, however, the use of class A exits is prohibited. The distance between nodes or intersections is understood as the distance between the intersections of the road axis at adjacent junctions or intersections.

It is desirable to aim at obtaining normative distances between nodes n of the A4 motorway in the vicinity of Wrocław. For example, for the section of the A4 motorway west of Wrocław, many transformations are planned, including the elimination of selected interchanges. This is shown in map 4.

4. Planned changes of interchanges location for the A4 motorway (from GDDKiA materials)

Near the west of the Bielany Wrocławskie interchange, the Pietrzykowice interchange is to be liquidated and replaced with a new facility (Strzeganowice interchange) located a few kilometers west of the current one in order to balance the intervals between the interchanges: Kąty Wrocławskie - Wrocław. Interchanges: Jarosław, Udanin, Legnickie Pole and others will be eliminated, and Kostomłoty and Kąty Wrocławskie will be rebuilt. The Bielany Wrocławskie interchange is planned to be rebuilt, however, the development of the area hinders drastic expansion, and any expansion will not change the proximity of the Wrocław South interchange. The Wrocław Południe (South) interchange is characterized by an extensive and functional scheme (see Fig. 5) implemented, inter alia, following analyzes from the report [3]. The quality differences between this node and the Bielański interchange are particularly striking, especially in relation to comparable traffic flows. According to GPR 2015 [4], the total daily traffic intensity for the Wrocław Południe interchange is 88.305 P/d, and for the Bielany Wrocławskie interchange - 82.642 P/d.

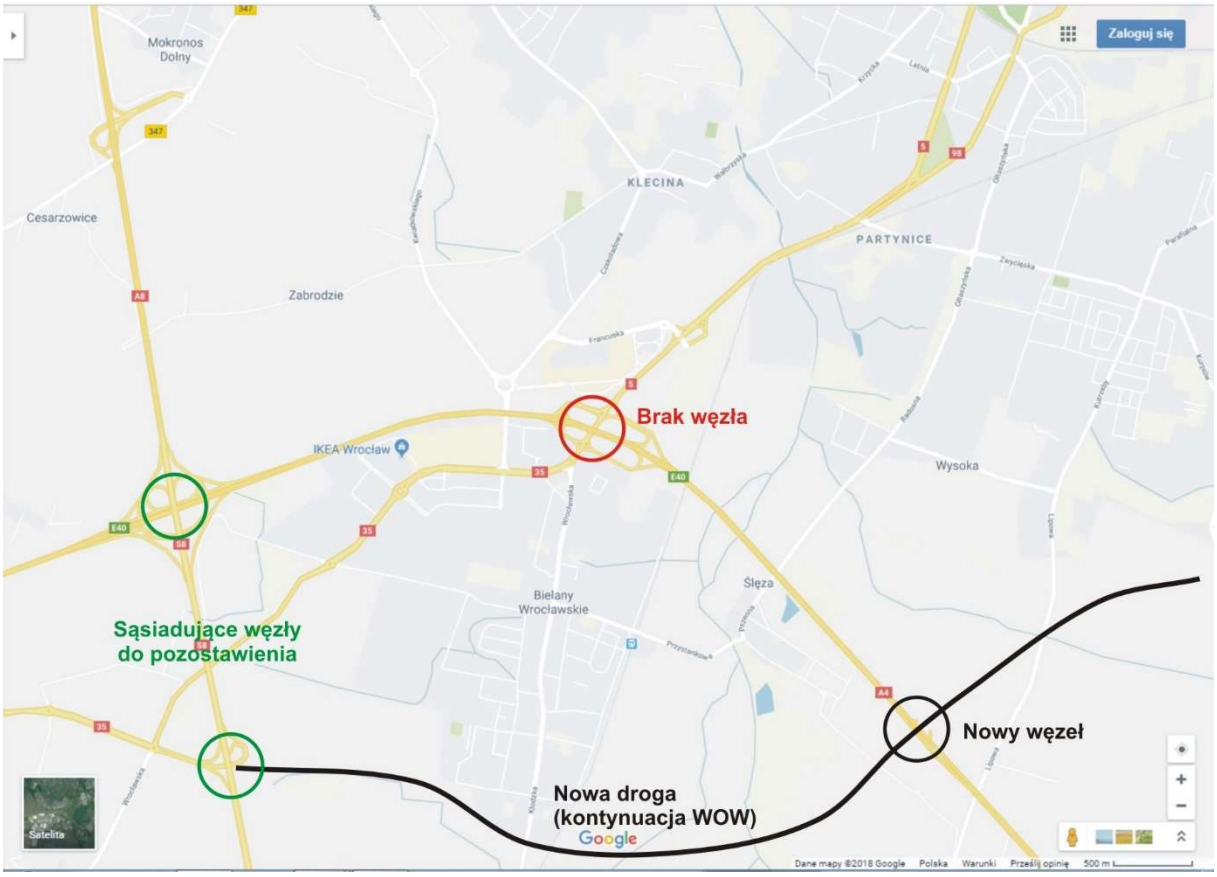


5. Diagram of the Wrocław Południe interchange (from the report [3])

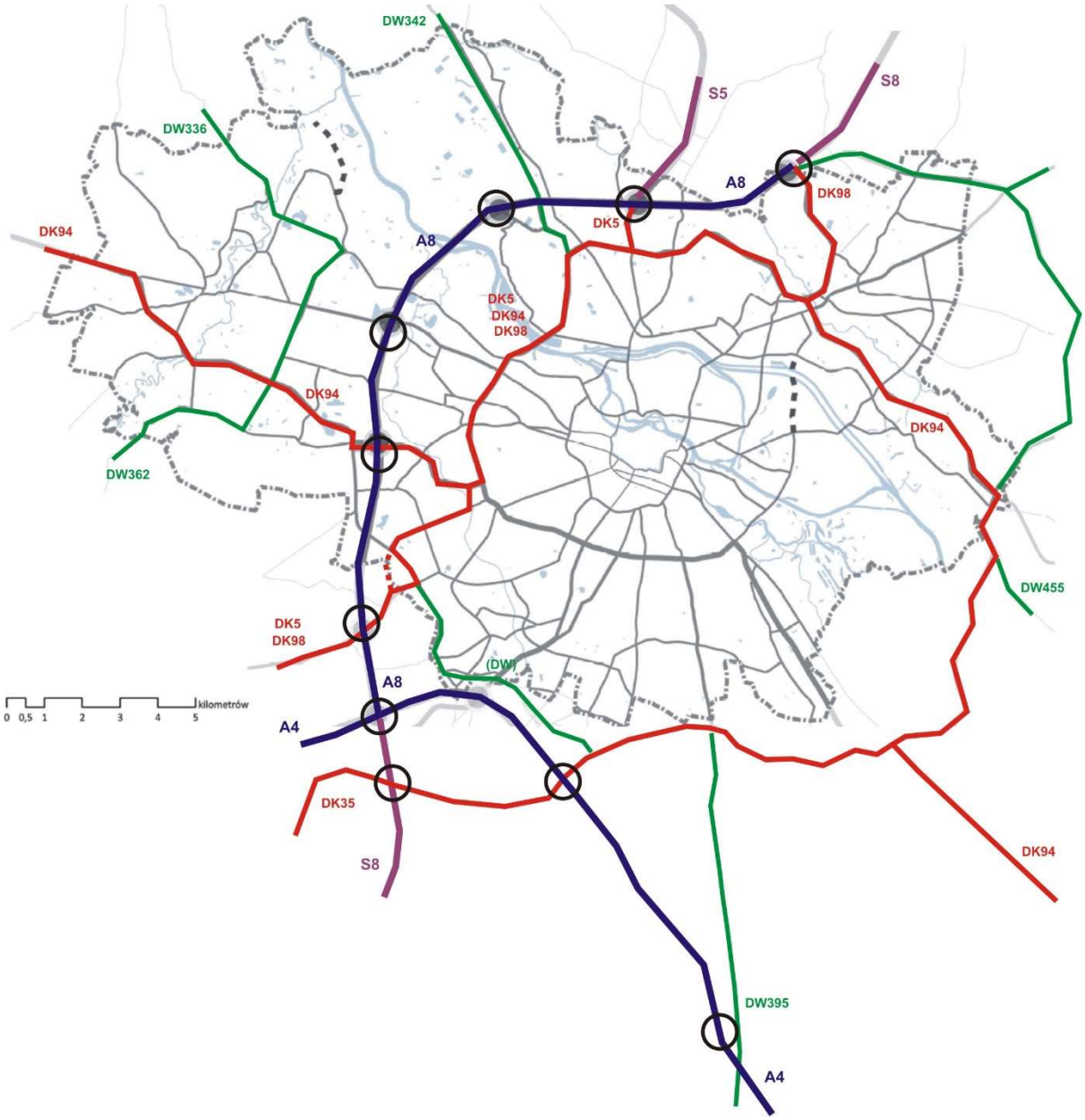
Author's proposal for the termination of the interchange

On the basis of the above-described conditions, it seems necessary to have a more decisive action regarding the Bielany Interchange. The article [2] presents the proposed modifications in the course of roads on the south side of Wrocław. The chart in Figure 6 corresponds with this. Today's Bielany Interchange for A4 is proposed for liquidation. The Eastern Bypass of Wrocław (Wschodnia Obwodnica Wrocławia - WOW) is here routed directly to the new A4 junction with a continuation towards AOW - S8 and DK35. The above solutions will allow for the creation of functional connections between the main roads surrounding Wrocław from the south, west, and east. The liquidation of the junction to A4 will "expand" connections with this route in the vicinity of Wrocław. The southern entrance to the city from the external zone will not be confronted with entrances from the motorway - the traffic will move to the more westward (existing) and east (proposed, not to be confused with the existing Wrocław East node located even further to the east). The location and layout of the "eastern" interchange require more detailed studies. Currently, there is an SOP in the vicinity of the proposed node. It is possible to liquidate it (with the introduction of another toll collection system in Poland)

or link to a new node (A4 section between the above-mentioned nodes would be free, as well as AOW, as part of the Wrocław ring-road system). The target bypass system is shown in Figure 7.



6. The proposed "solution" of the interchange (based on the map https://www.google.com/maps)



7. The proposed target system of bypasses and interchanges around Wrocław (based on a map from the Study on Conditions and Directions of Spatial Development of Wrocław 2018, https://gis.um.wroc.pl/imap/?gpmap=Studium2018)

Summary

The "termination" of the interchange proposed by the author is of a radical nature, meaning liquidation in the current situation. The "sentiments" and "tradition" of the interchange's location in this particular place may influence the decision. The traffic conditions and the desire to create a functional and normative network of roads surrounding Wrocław and connections between them, however, indicate the necessity of a significant redistribution of traffic and its ordering. It seems that the proposed solution will not degrade the accessibility of facilities located in the vicinity of the current node and leaving only a drive over the motorway in relation Wrocław and its surroundings will significantly contribute to the improvement of traffic conditions, including its safety, which also applies to the A4 motorway itself. Conducted in 2018 renovation of the switchboards connected with successive exclusion from traffic, showed that it is possible to operate the motorway environment without the functioning of interchanges (and, in the guise of the Bielański Interchange). Entrances and

departures from Wrocław to the motorway can be successfully accomplished through neighboring nodes (including the new one in the proposed location). Then what? There is a long talk about the need to terminate the node. It's time to make a decision.

Source materials:

[1] Kaliński J. „Jak powstała autostrada A4?", Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Historyczne 144, z. 4 (2017), s. 833–855 www.ejournals.eu/Prace-Historyczne

[2] Kruszyna M., Suchy G. „Logika uzupełnień głównej sieci drogowej", Przegląd Komunikacyjny, 2015, R. 70, nr 10, s. 22-24

[3] Kruszyna M., Szydło A. „Prognoza ruchu dla autostradowej obwodnicy Wrocławia". Raporty Inst. Inż. Ląd. PWroc. 2005, Ser. SPR nr 95

[4] Opoczyński K. „Synteza wyników GPR 2015 na zamiejskiej sieci dróg krajowych", załącznik z wykazem GPR 2015 dla DK, GDDKiA Warszawa 2016 https://www.gddkia.gov.pl/pl/2551/GPR-2015

[5] Rozporządzenie Ministra Transportu i Gospodarki Morskiej z dnia 2 marca 1999 r. w sprawie warunków technicznych, jakim powinny odpowiadać drogi publiczne i ich usytuowanie (wersja: Załącznik do obwieszczenia Ministra Infrastruktury i Budownictwa z dnia 23 grudnia 2015 r., poz. 124)

[6] Wikipedia: o Węźle Bielańskim, https://pl.wikipedia.org/wiki/Bielany_Wroc%C5%82awskie