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EVALUATION OF THE TRANSPORT POLICY IN POLAND USING DAILY ACCESSIBILITY INDICATOR – 2015 AND 2030

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Abstract

The paper outlines application of the Accessibility Model for Evaluation of Transport Infrastructure Policy (AMETIP) using a graph for domestic transport system in Poland defined on 2015 data and the assumptions for 2030. Transport policy was evaluated in respect of the EU policy cohesion goal – "90% of inhabitants able to complete their journey within 4 hours of a door to door travel". To prepare 2030 outlook of the transport system, the official documents describing plans for improvement of multimodal transport system in Poland were used. In brief, the documents assumed: completing highways, expressways, improving tracks, rolling stock acquisition as well as activating new airports. It was also assumed that Poland will keep on the improvements effort and the European Union will continue to co-fund them. With these assumptions, results show, that Poland is on the path to make a significant step forward in improving daily accessibility in line with the EU cohesion goal. Unfortunately, the calculations seem to show the impossibility to achieve the mentioned ambitious cohesion goal in Poland within the current agenda. Some alternative, complementary solutions need to emerge.
Keywords: transport policy, daily accessibility, European Union cohesion goals.

1. INTRODUCTION

The Polish transport policy has been coordinated according to the EU Cohesion policy defined by 1986 Single European Act and 2009 Lisbon Treaty as well as the domestic law on development [2].

The objectives and initiatives for EU transport policy for another decade and a vision for 2050 were set out in the 2011 White Paper ("Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system") [3]. One of the 2011 White Paper initiatives ("34. A core network of strategic European infrastructure – A European Mobility Network") called for new the Trans-European Transport Networks (TEN-T) guidelines and named the TEN-T programme as a tool to achieve territorial cohesion by integrating eastern and western part of the EU, shaping the Single European Transport Area and foreseeing connections with neighbouring countries by adequate funding instruments. Further clarification of the cohesion goal appeared in European Commission DG for Mobility and Transport document [4] **("90% of travellers within**

Europe are able to complete their journey, door-to-door within 4 hours"). Accessibility and a strong focus on infrastructure are key aspects of this strategy.

The new TEN-T guidelines [1] identified parts of two TEN-T corridors in Poland: the North Sea-Baltic (red in Figure 1) and Baltic-Adriatic (blue in figure 1). With the two corridors in focus, the dedicated support of Connecting Europe Facility [5] integrated with other EU funds also accelerates the domestic transport system improvements and cohesion as assumed in Polish "Strategy for Transport Development" [6]. More details of Polish transport policy are presented in chapter 2. In chapter 3, an attempt to evaluate the situation if EU and Polish plans come to fruition in 2030 (baseline scenario) is shown. Accessibility Model for Evaluation of Transport Infrastructure Policy (AMETIP) is applied [7] using the prepared graph for the year of 2015 [8]. Another graph was prepared for the expected situation in 2030. Daily accessibility change due to infrastructure improvements was estimated to answer if the EC DG for Mobility and Transport cohesion goal in Poland is achieved by this time.

Fig. 1. Polish part of the TEN-T core network and corridors [1] [TENtec 2016]

2. TRANSPORT INFRASTRUCTURE DEVELOPMENT PLAN IN POLAND

2.1. Road system

In 2004, Polish government made the first, coordinated with TEN-T, commitment to complete 2,000 km of highways and 5,300 km of expressways until 2030 [9]. The last modification of the commitment, issued in 2015, adjusted the network and extended the length of expressways to 7,500 km [10]. If the highways development continues as planned it seems the commitment is fulfilled between the year of 2030 and 2035. This situation is assumed as a baseline scenario for 2030. (See figure 2).

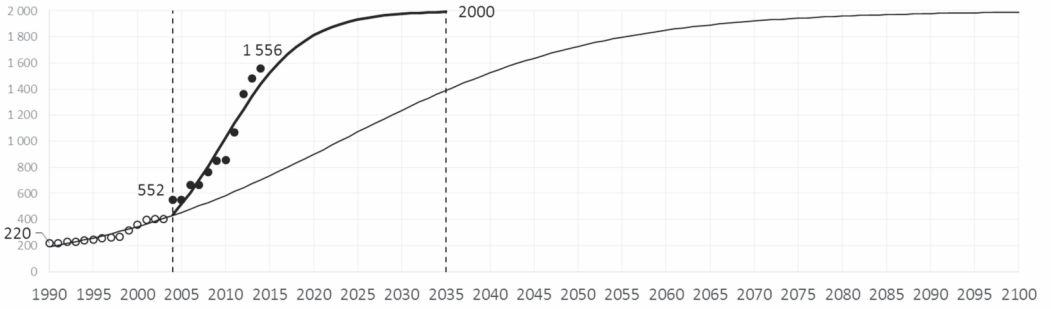


Fig. 2. Highways development trend in Poland – pre-accession (1990-2003) and in the EU (2004-) [Mączka 2016]

However, in the case of any critical events, such as the European Union sudden funding decline (or even stop) or the country security deterioration, the infrastructure development may cease to be improved or postponed. A trend line averaged on the pre-accession period data (1990-2004) can suggest the alternative completion date.

In figure 3, I presented a source and a model of the expected road system in Poland. The source was the official 2015 map showing the improvements plan until 2030 and prepared by the General

Directorate for National Roads and Motorways (GDDKiA) of the Polish Ministry of Infrastructure and Development (the map on the left) [11]. The model, that is the "road system 2030" layer of the graph, is my emulation of the expected situation presented in the source map (the map on the right).

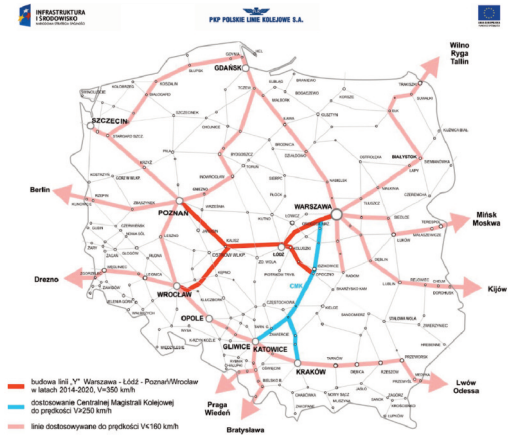
[GDDKiA, 2015] [Mączka, 2016]

Fig. 3. The GDDKiA target map [11] and the "road system 2030" layer of the graph (NUTS0 Poland)

2.2. Railway system

In the 2008 resolutions, the Polish government decided to develop high speed train transport system until 2020 [12] and to revitalise conventional railways (the Master Plan) [13]. According to the high speed programme, Warsaw is to be accessible by railway from Poznań and Wrocław using tracks upgraded to 350 km/h, and, from Katowice and Kraków using tracks capable of 250 km/h. The rest of the crucial rail tracks are planned to be upgraded to a maximum speed of 160 km/h. I developed the "2030 railway system" layer of the graph assuming the following:

- postponing high-speed railway system completion (including new rolling stock) date from 2020 to 2030;
- maintaining all other than high speed tracks in current status;
- combining the planned improvements with the previously [8] defined "railway system" layer for 2016. (See figure 4).



[PKP SA, 2008] [Mączka 2016]

Fig. 4. The PKP, PLK S.A. modernisation plan [13] and the "railway system 2030" layer of the graph

2.3. Airlines system

The 2030 trends for domestic airlines system in Poland are more uncertain than for land modes of travel. Many air routes will be exposed to strong and potentially devastating competition of the expected high speed train system [12]. Airline system offers flexibly follow seasonal demand, adjust capacity to external shocks. Even the so-called incumbent, national flag carrier airlines cannot be sure of their future [14].

The ground infrastructure of air transport changes, not necessarily, according to the initial plans. The Program for Airport Network and Ground Equipment Development of 2006 [15] mentioned a never completed new central airport in Poland. Instead, two new airports (Modlin EPMO, Radom EPRA) emerged although they had been unplanned in 2006. Whereas, the planned modernisation, development and activation of five airports in warmińsko-mazurskie, podlaskie, lubelskie, zachodniopomorskie and świętokrzyskie voivodships was embodied by only two airports (Lublin EPLB, Olsztyn EPSY) that started operations until 2016. (See figure 5).

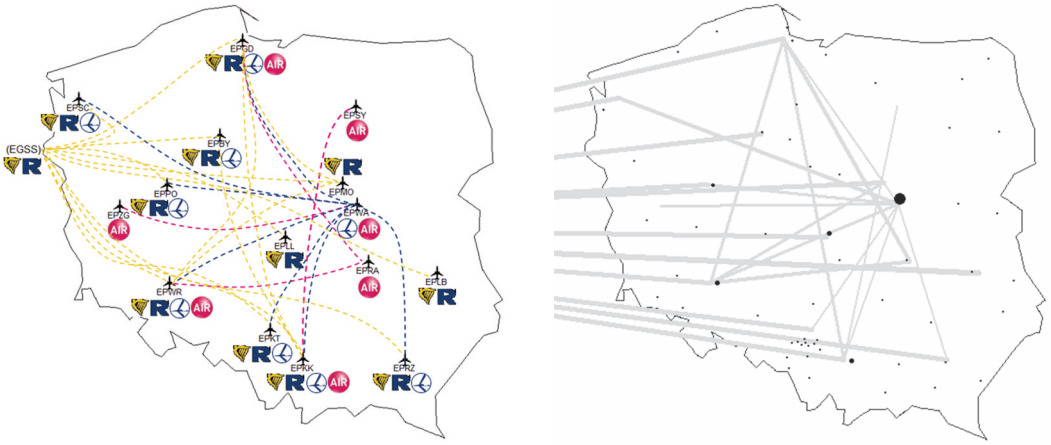


Fig. 5. The expected airlines offer [4] and the "airlines system 2030" layer of the graph [Mączka 2016]

Despite the expected high speed train competition, the 2030 airlines system is assumed to offer equal to the offer of 2016 with some minor changes sparked by the SprintAir expansion from the new airports (EPRA Radom, EPSY Olsztyn-Mazury). Consequently, the graph layer of the "2030 airlines system" was similar to the one of 2015 including London-Stansted as a hub integrating Polish domestic connections.

3. EVALUATION OF TRANSPORT POLICY

3.1. Daily accessibility in 2015

Using the graph of Polish multimodal transport system of 2015 [8] and the AMETIP method [7] total daily multimodal accessibility was estimated. Only **17%** of Polish population was able to reach 90% of the population in 4 hours door-to-door travel (complied to the cohesion goal). The map and the chart in figure 6 presents this maximum theoretical capability of the system. The colours intensity (blue, green, yellow, orange, red, black) shows the level of daily accessibility (blue: the highest = 1, black: the lowest = 0).

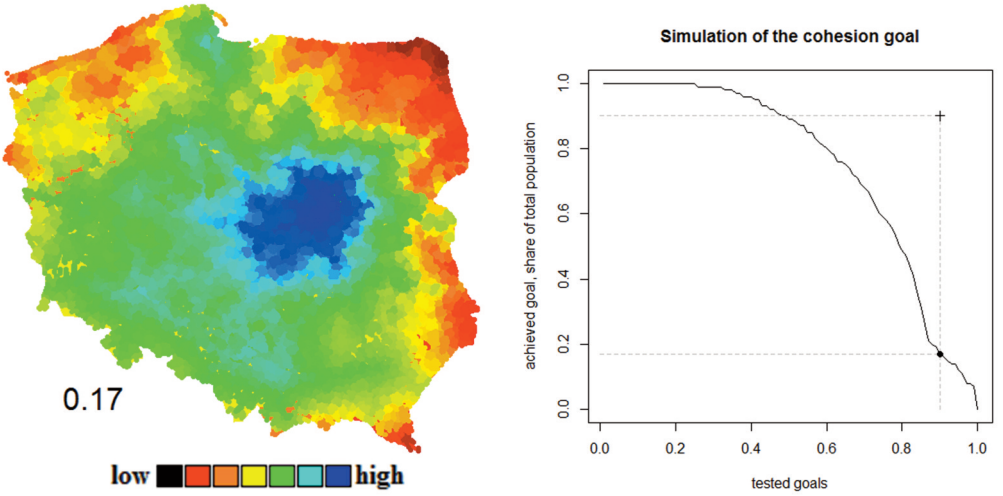


Fig. 6. 2015 - multimodal daily accessibility levels left: 17% of 2479 communes is able to reach 90% of population within 4 hours of door-to-door travel; right: "the point" – current situation with respect to the cohesion goal; "the cross" – the cohesion goal; "arrow" – the desired transformation [Mączka 2016]

The curve (see figure 6, right side) shows, in a decreasing order, the level of cohesion goal achievement by all, 2,479 communes in Poland. Most of them failed. Only a short list of the communes, located in the central part of the country (dark blue, around Warsaw) fulfilled the requirement. Higher accessibility pattern (light blue, green) match the current pattern of highways and express roads.

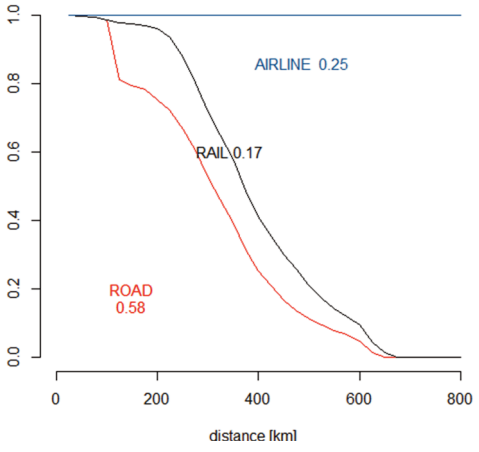


Fig 7. Modal split of 2015 (using theoretical min. travel time) [Mączka 2016]

The lowest levels of daily accessibility are in three corners of the country: the north-western, the south-eastern and the north-eastern ones (red). Transformation of transport system towards the cohesion goal ("arrow" towards "the cross") will lead to "blueing" of the map (see chapter 3.2).

Summing up, all inhabitants potentially travelling to all other communes by particular means of transport generates data for modal split chart. The 2016 results indicate road transport was dominating in every distance interval up to 250 km. In total, for 58% of population no other mean was better than car or bus travel in terms of door-to-door travel time. For only 17% of population railway system enabled quickest travel. It was true for communes located near the train access nodes (the bigger cities of Poland). Air transport, gradually, win its share of 25% of population among travels longer than 250 km.

3.2. Baseline scenario 2030

Using the defined above graph for 2030 and the AMETIP method, the impact of completing all improvements was estimated. Thousands of kilometres of new highways, expressways and high

speed rail tracks are expected to significantly improve daily accessibility (to **66%**), As expected, the improvements "blued" the map in most of its area. It means that much of the central part of Poland would fulfil the cohesion goal, but, still, it would not be the assumed 90% of population. (See figure 8).

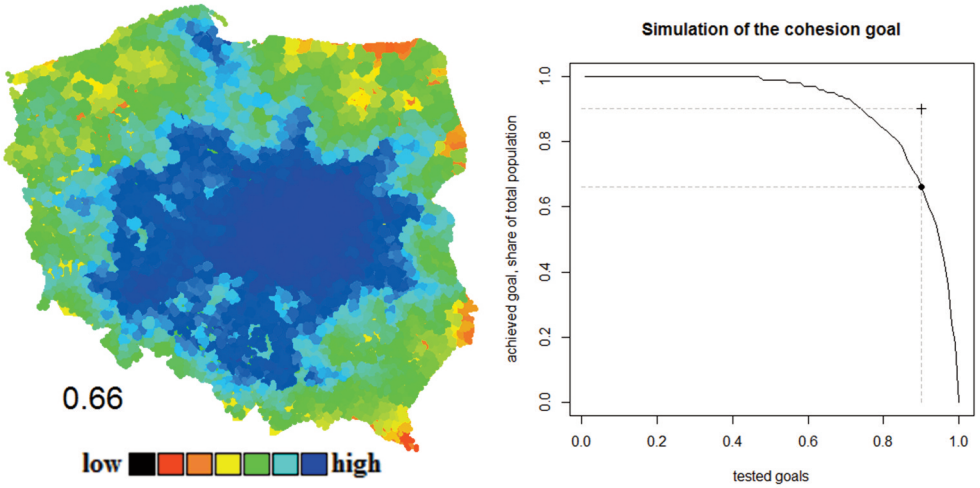


Fig. 8. 2030 - the expected multimodal daily accessibility levels left: 66% of 2479 communes is able to reach 90% of population within 4 hours of door-to-door travel; right: "the point" – expected situation with respect to the cohesion goal; "the cross" – the cohesion goal [Mączka, 2016]

Modal split of 2030 is expected to shift the system towards higher significance of railway transport.

For 41% of total population train would be the shortest time mode of travel. Airlines and road transport share will decrease to 13% and 46%, accordingly.

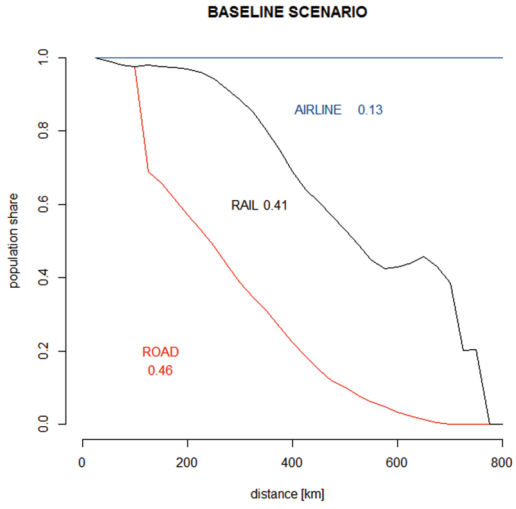


Fig. 9. Modal split of 2030 (using theoretical minimum time) [Mączka, 2016]

4. VALIDATION OF RESULTS

Road accessibility

The Institute of Geography and Spatial Organization of Polish Academy of Sciences (IGiPZ PAN) specialises in transport accessibility in Poland [16]. Using their maps of potential accessibility by road [17] as reference points an attempt was made to validate the results by a visual inspection. The IGiPZ PAN potential accessibility and the AMETIP daily accessibility aimed to answer the same question – "what is the accessibility of all locations of transport system from location i?" The difference is the purpose and the mathematical formulation. (See table 1).

Table 1. Comparison of two accessibility measures

Potential accessibility of IGIPZ PAN, 2015	Daily accessibility of AMETIP method, 2016
IGiPZ PAN potential accessibility $D_i = M_i * f(K_{ij}) + \sum_{j=1..n, j<>i} (M_j * f(K_{ij}))$ where: M – attractiveness mass of region, e.g. population, wealth f(K) – impedance function, e.g. distance, time, cost	AMETIP total daily accessibility $daily\ accessibility = \sum_1^j population_j \quad if\ A_i > 0{,}90$ where: $A_i = \frac{accessibile\ population_i}{total\ population}$ $accessibile\ population_i = \sum_1^j pop_j \quad if\ d_{ij}{}^{(k)} < 4$ d – time of transport (shortest paths by road)

The IGiPZ indicator indicated a generalised potential. The AMETIP tested the cohesion goal achievement. (See figure 10).

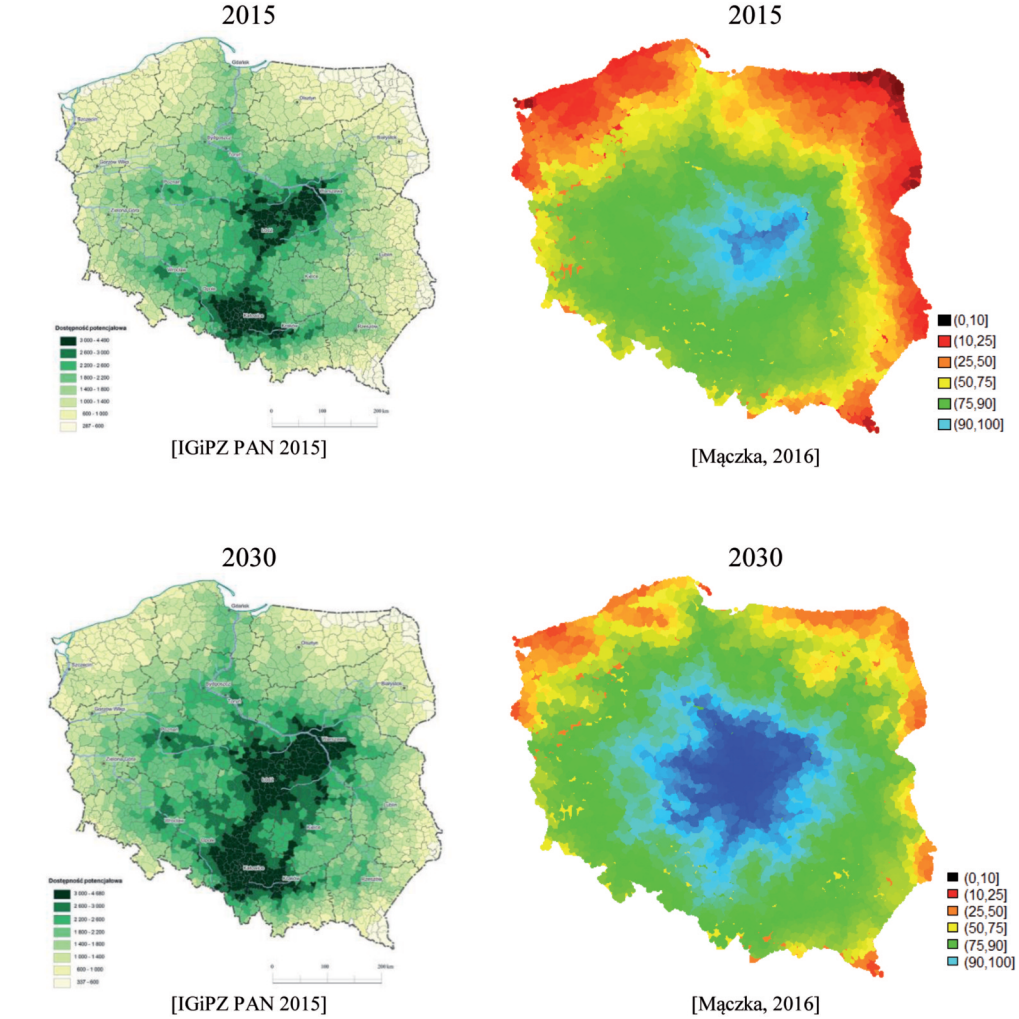


Fig. 10. Road transport accessibility: (left) potential IGiPZ PAN (2015 and 2030) [17] and (right) daily AMETIP (2015 and 2030)

The IGiPZ potential accessibility is calculated using a more complex attractiveness mass component. Unfortunately, the IGiPZ indicator cannot be used to validate my results.

Railway accessibility

Another interesting application of accessibility measure was presented in 2014 by the Joint Research Centre for European railways [18], which was applied to all other modes (including air travel) [19]. The analysis reached the depth of NUTS3 level using four " 'partial' accessibility sub-indicators derived from a negative exponential functions". The outcome provided localization of major benefits in terms of accessibility. Prioritization of investment seems to be excellent at the EU, general overview level because the sensitivity analysis included hypothetic 3 scenarios converging all inter-NUTS3 connections to minimum 200 km/h (1), 90 km/h (2), maximum 45 km/h (3). (See figure 11).

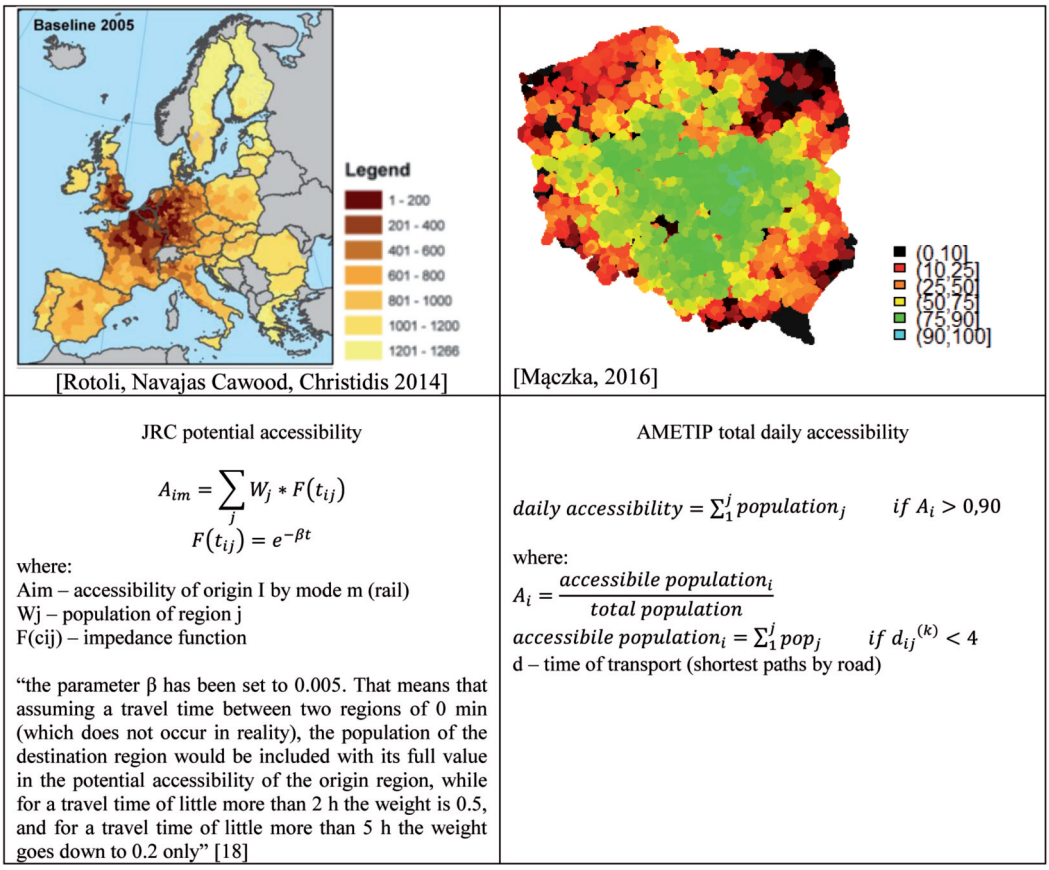


Fig. 11. Railway transport accessibility: (left) potential by JRC in 2005 and (right) daily (AMETIP) in 2015

Unfortunately, the JRC results pose also a poor reference for the AMETIP railway accessibility due to definition differences, despite the fact that time of travel is the main component in both methods.

5. CONCLUSION

Further expansion of traditional modes of transport, despite heavy efforts, are not going to lead to the cohesion goal achievement in the end. Billions of euro improvements would elevate daily accessibility of population from 17% to 66% until 2030. The level of 90% would be, still, ahead.

Some attempts to validate the results using other institutions outcomes were performed. Unfortunately, the conclusions match in some parts only. For example, contrary to IGPiZ PAN map [17], the AMETIP accessibility of 2015 in communes of Śląskie, Małopolske voivodships did not have a higher total daily accessibility obtained by the AMETIP method. Yet, despite differences in approach, the AMETIP outcomes correspond with the Joint Research Centre suggestions of 2014 [18] that there is room for improvements in railway speed in Poland.

The AMETIP indicates that the communes located remotely from the high speed train access nodes or travelers desiring to reach communes that are unconnected by the expected high speed train tracks, highways or expressways need an alternative, novel mode of transport that would substantially impact daily accessibility of most of the citizens. A mode that would be fast, green, safe, affordable and, above all, proportionally accessible all over the country.

The research of the Institute of Aviation [19] on the transportation systems networks will be continued:

- to simulate potential new modes of travel (such as European Personalized Air Transport System, EPATS [20]) impact on the AMETIP [7] daily accessibility in Poland.

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OCENA POLITYKI DOTYCZĄCEJ INFRASTRUKTURY TRANSPORTOWEJ W POLSCE

Streszczenie

Artykuł przedstawia zastosowanie poprzednio opisanej metody nazwanej jako Model Dostępności Transportowej do Testowania Założeń Polityki Infrastrukturalnej (AMETIP) wykorzystującej graf krajowego systemu transportowego w Polsce zdefiniowany używając dane z 2015 roku i założenia dla roku 2030. Dokonano oceny polityki transportowej z punktu widzenia celu spójności regionalnej w polityce Unii Europejskiej – „90% mieszkańców ma możliwość ukończenia podróży od drzwi do drzwi w ciągu 4 godzin". Do przygotowania perspektywy na rok 2030 wykorzystano oficjalne dokumenty opisujące plany rozbudowy multimodalnego systemu transportowego w Polsce zakładające: ukończenie autostrad, dróg szybkiego ruchu, ulepszenie trakcji i zakup składów kolejowych jak również uruchomienie nowych portów lotniczych. Przyjęto, że Polska będzie kontynuować wysiłek rozbudowy, a Unia Europejska utrzyma współfinansowanie. Porównanie wyników pokazuje, że Polska zamierza wykonać istotny krok na przód w kierunku poprawienia dziennej dostępności mieszkańców Polski w kierunku celu spójności polityki regionalnej UE. Niestety, obliczenia wydają się wskazywać, że obecna polityka nie doprowadzi do osiągnięcia wspomnianego, ambitnego celu polityki spójności UE. Niezbędne są nowe, komplementarne rozwiązania.
Słowa kluczowe: polityka transportowa, dzienna dostępność transportowa, cele polityki spójności Unii Europejskiej.