CONCEPT OF THE "LAST MILE" OF FREIGHT TRAFFIC ON THE CITY ROAD NETWORK FOR THE BYDGOSZCZ LOGISTICS HUB

Report

Activity: WP 4, Activity 4
Version: FINAL
Date: 28/09/2020

Jan Kempa, Jacek Chmielewski, Damian Iwanowicz, Marcin Karwasz, Radosław Klusek, Paulina Olenkowicz-Trempała, Damian Wiśniewski
"Rozwój UTP" Foundation

Table of Contents

1 INTRODUCTION

BASIS FOR THE STUDY

The basis for the study is a contract No. WZR-V.271.2.35.2019 concluded on November 29, 2019 in Bydgoszcz between the City of Bydgoszcz, NIP 953 10 11 863, with the seat of the authorities in Bydgoszcz at Jezuicka 1 Street, on behalf of which, under the authority of the Mayor of Bydgoszcz, acts Ms Maria Wasiak - Deputy Mayor of Bydgoszcz, and the Foundation "Rozwój UTP", based in Bydgoszcz, at al. prof. S. Kaliskiego 7, 85 - 796 Bydgoszcz, NIP 5540169805, REGON 090463052.

PURPOSE AND SCOPE OF THE STUDY

The immediate objective of this study is to determine the impact of the planned construction and commissioning of two multimodal freight ports:

1. Bydgoszcz Logistics Hub (Bydgoszcz-Solec Kujawski multimodal platform),
2. Emilianowo road and rail terminal,

on the truck vehicle traffic in the area of the city of Bydgoszcz. This goal is to be achieved through mathematical analyzes based on the transport demand model of the city of Bydgoszcz for the forecast period of the years: 2025-2050. This period can be considered as a theoretically possible period of launching the abovementioned multimodal ports.

The scope of the study, in accordance with the contract, covers four main issues listed below:

1) Preliminary identification of sources and purposes of freight transport traffic in the City of Bydgoszcz, broken down by means of transport, if possible, on the basis of available databases on economic activity and available spatial information, available traffic studies, with particular emphasis on commercial distribution centers located in the city (Lidl, Pannatoni Europe, etc.). The Contractor will apply for the data. Visum software or an analogous/compatible software should be used for forecasts purposes, so that the results of the work can be used by the Employer.
2) Spatial distribution of freight flows on the City's road network - burden on the road network by freight traffic.
3) Identification of key customers and operators, i.e. recipients, producers and distributors of goods - potentially interested in combined transport using the Bydgoszcz Logistics Hub (multi-modal platform Bydgoszcz-Solec Kujawski and the Emilianowo rail terminal) on the basis of data collected in point 1. Account should be taken of customers and operators using means of transport characteristic for combined transport, i.e. containers, trailers and oversized loads. The criteria for selecting key customers should be agreed with the Employer in the course of the work. Selected key recipients should be surveyed in terms of determining the supply chain, taking into account the source and / or destination (region of Europe, the world). It will also be important to obtain information on logistics requirements (in particular, sensitivity

to punctuality, regularity, delivery time). The information obtained should be supplemented with an analysis of generally available data on selected key companies. The survey template should be agreed with the Employer.

4) Forecast of the distribution of freight traffic in the City area, taking into account the operation of the Logistics Hub Bydgoszcz (multi-modal platform Bydgoszcz-Solec Kujawski and the Emilianowo rail terminal) prepared on the basis of the analyzes results in point 3 based on road transport.

2 CHARACTERISTICS OF THE AREA COVERED BY THE STUDY

2.1 TRANSPORT CHARACTERISTICS OF BYDGOSZCZ[1]

General characteristics of the city

The area covered by the analysis is the city of Bydgoszcz. The location of the city against the background of Europe is shown in Fig. 2.1. Compared to the rest of the country, Bydgoszcz is located in the north-west, central part of Poland, while against the background of the Kujawsko-Pomorskie Voivodeship in its west-central part. Bydgoszcz is one of the two capitals of the Kujawsko-Pomorskie Voivodeship and, together with Toruń, is a metropolitan duopoly of this region of Poland. The situational plan of Bydgoszcz is presented in Fig. 2.2 [OpenStreetMap]. It shows that the city's buildings are clearly stretched east-west.

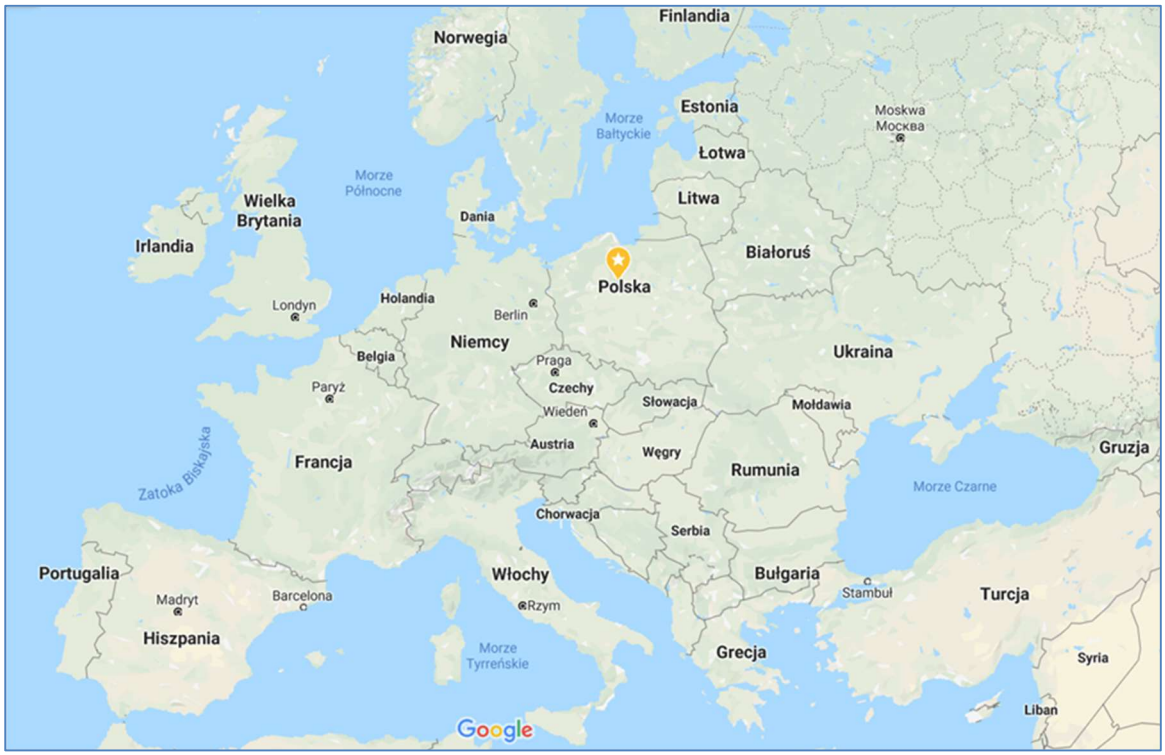


Fig. 2.1. Location of the city of Bydgoszcz against the background of European countries [maps.google.com]

Bydgoszcz, in 2019 [29], was inhabited by just over 350 thousand inhabitants, which, in terms of the surface area of this city, which is 175.98 km^2, gives a population density of 1979 inhabitants/ km^2. This means that it is a medium-sized urban unit. Unfortunately, in recent years the number of inhabitants has significantly decreased, because within 5 years there has been a decrease by over 7 thousand inhabitants (decrease by ~ 2.09% in relation to 2015).

[1] Figures based on [29]

According to the 2019 City Report [29], the city's land structure at the end of 2019 was as follows:

- agricultural land: 18%,
- forest land: 31%,
- built-up land: 42%,
- land under water: 4%,
- others: 5%.

The following length of the network was recorded at the beginning of 2019:

- water supply - 1 050.9 km (97% of residents used it),
- sewage - 875.0 km (93,1% of residents used it),
- storm water - 598.5 km,
- heat - 398.8 km (87,9% of the apartments were connected to it),
- power supply - 278.5 km,
- gas - 736.8 km (80,4% of residents used it).

Fig. 2.2. Map of Bydgoszcz [www.bydgoszcz.pl]

Road transport

The transport network of Bydgoszcz (2019) constitutes 4.4 km/ km^2 of the city's area. The city's transport system is shown in Fig. 2.3. Public roads within the city area constitute the following road categories:

- national – 40.21 km,

- regional – 10.94 km,
- sub-regional – 132.56 km,
- local – 553.8 km.

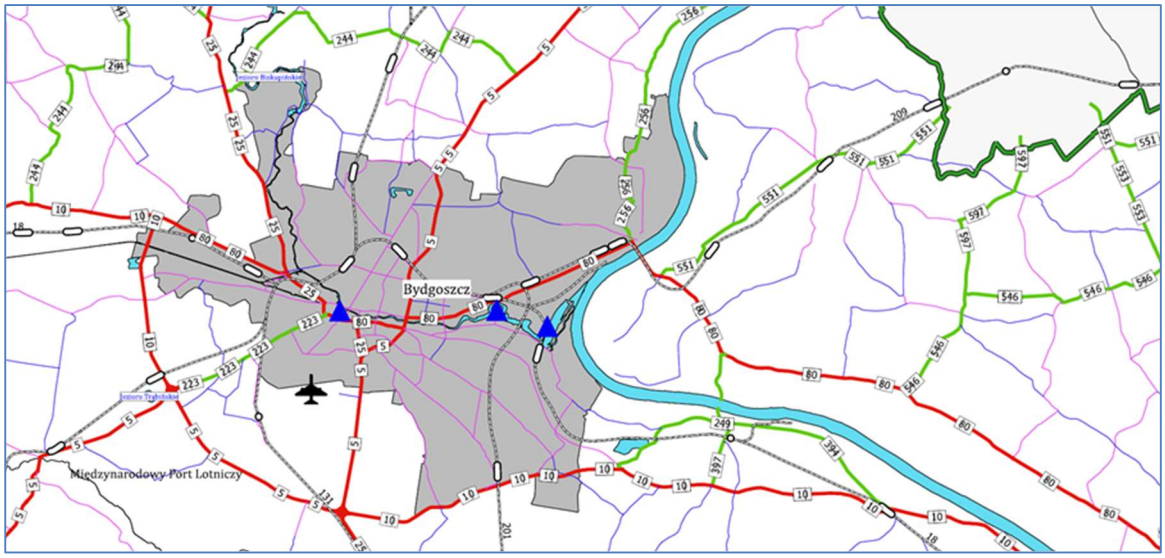


Fig. 2.3. Transport network of the city of Bydgoszcz [Study, 2016]

In terms of transport infrastructure, Bydgoszcz also possesses (excluding railway and private facilities):

- 42 bridges,
- 39 flyovers and overpasses,
- 17 pedestrian bridges,
- 4 tunnels,
- 4 underpasses,

There are 6 main road routes through Bydgoszcz. From the following sides:

- northern - national road No. 5 towards the Tri-City metropolis (Gdańsk, Sopot, Gdynia),
- eastern - national road No. 80 towards the second metropolitan core, i.e. Toruń,
- southern - national road no. 25 towards Inowrocław and then Konin,
- south-west - national road No. 5 towards Poznań,
- west - national road No. 10 towards Piła and further to Szczecin,
- north-west - national road no. 25 towards Sępólno Krajeńskie and then Koszalin.

Currently, in the Bydgoszcz region, construction works are underway to build the expressway No. S5, connecting Wrocław, Poznań, Bydgoszcz and further leading to the road interchange with the A1 motorway (Nowe Marzy). In addition, it is also planned to construct the S10 expressway, connecting the two capitals of the voivodeship, Bydgoszcz and Toruń, which in the long term will also connect Bydgoszcz with the capital of the country - Warsaw.

Fig. 2.4. shows a spatial distribution of the traffic volume of motor vehicles determined based on the Bydgoszcz transport demand model for 2015.

The number of motor vehicles in the city in 2019 was over 257 thousand pcs and in the last 5 years it increased by as much as 13,2%. The number of passenger vehicles per 1.000 inhabitants in 2019 was 619 vehicles, which proves that the society living in the city is quite motorized. The total number of taxi licenses issued was 1.300.

In the central part of the city, there is a special metered parking zone, which is divided into two sub-zones (Fig. 2.5). The metered parking applies from 8am to 5pm, every working day.

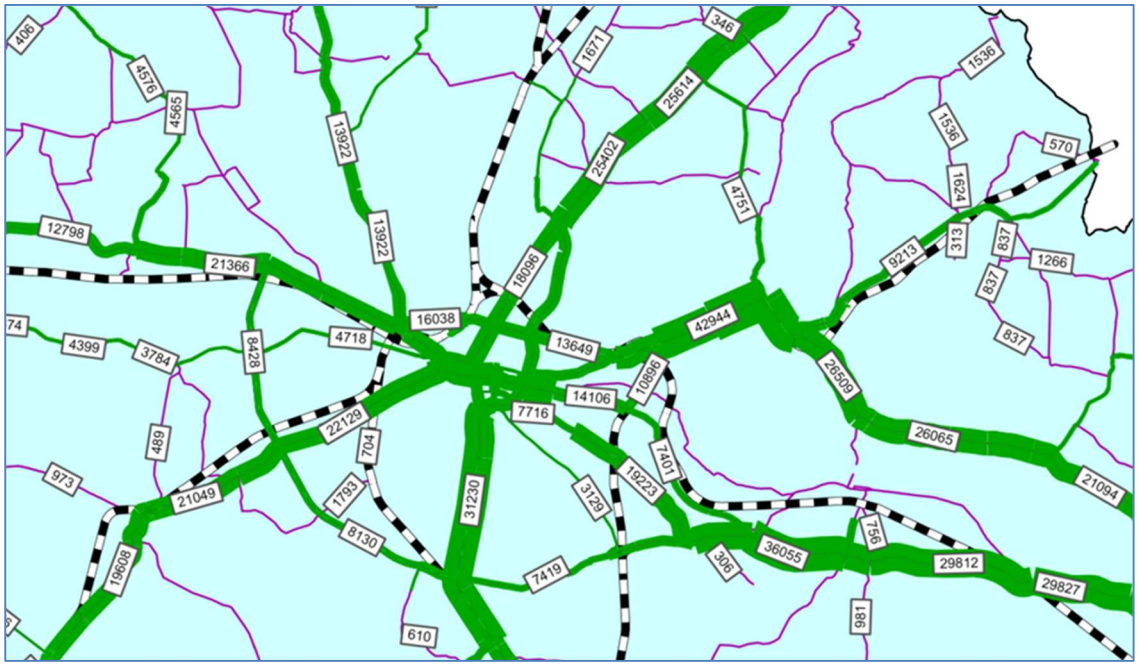


Fig. 2.4. Distribution of traffic volumes of motor vehicles on a typical working day in 2015 in the city of Bydgoszcz [Study, 2016]

Fig. 2.5. Metered parking zones in the center of Bydgoszcz [www.zdmikp.bydgoszcz.pl]

Public transport

The public transport lines in Bydgoszcz is organized in such a way that the backbone of the most important transport corridors are tram lines, and it is complemented by feeder or peripheral bus lines, penetrating the city space wherever the expansion of the tram system is impossible or economically unjustified. The diagram of bus and tram lines is shown in Fig. 2.6.

In 2019, the total length of active bus routes was 286 km, and tram routes - 40 km. In the same year, a total of 91.9 million passengers were transported, of which 61.9 million (67.4%) traveled by public bus transport, and 30.0 million (32.6%) by public tram transport.

The public transport fleet consists of 218 buses and 134 trams according to data for 2019. The number of public transport stops was 930, of which 175 were tram stops and 749 bus stops. The length of bus lanes in 2019 was only 9.4 km.

Fig. 2.7. shows a spatial accessibility to means of public transport, with the assumed radius of the range of potential passenger service equal to 450 m.

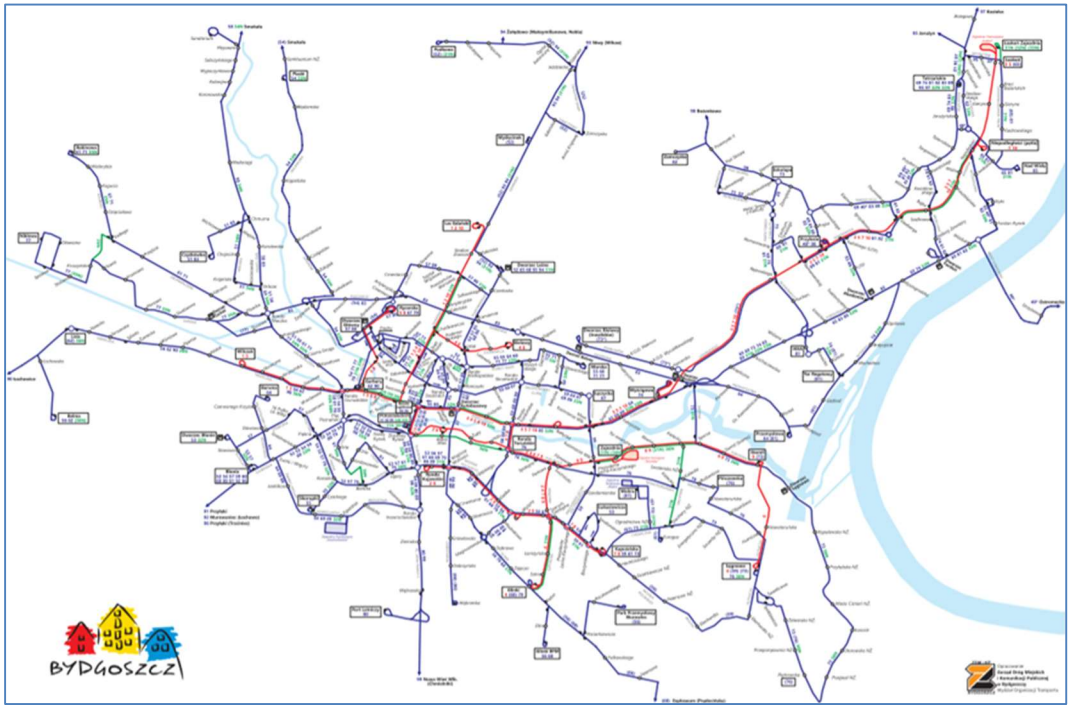


Fig. 2.6. The layout of communication lines in Bydgoszcz (red - the network of tram lines, blue - the network of day bus lines, green - the network of night bus lines) [www.zdmikp.bydgoszcz.pl]

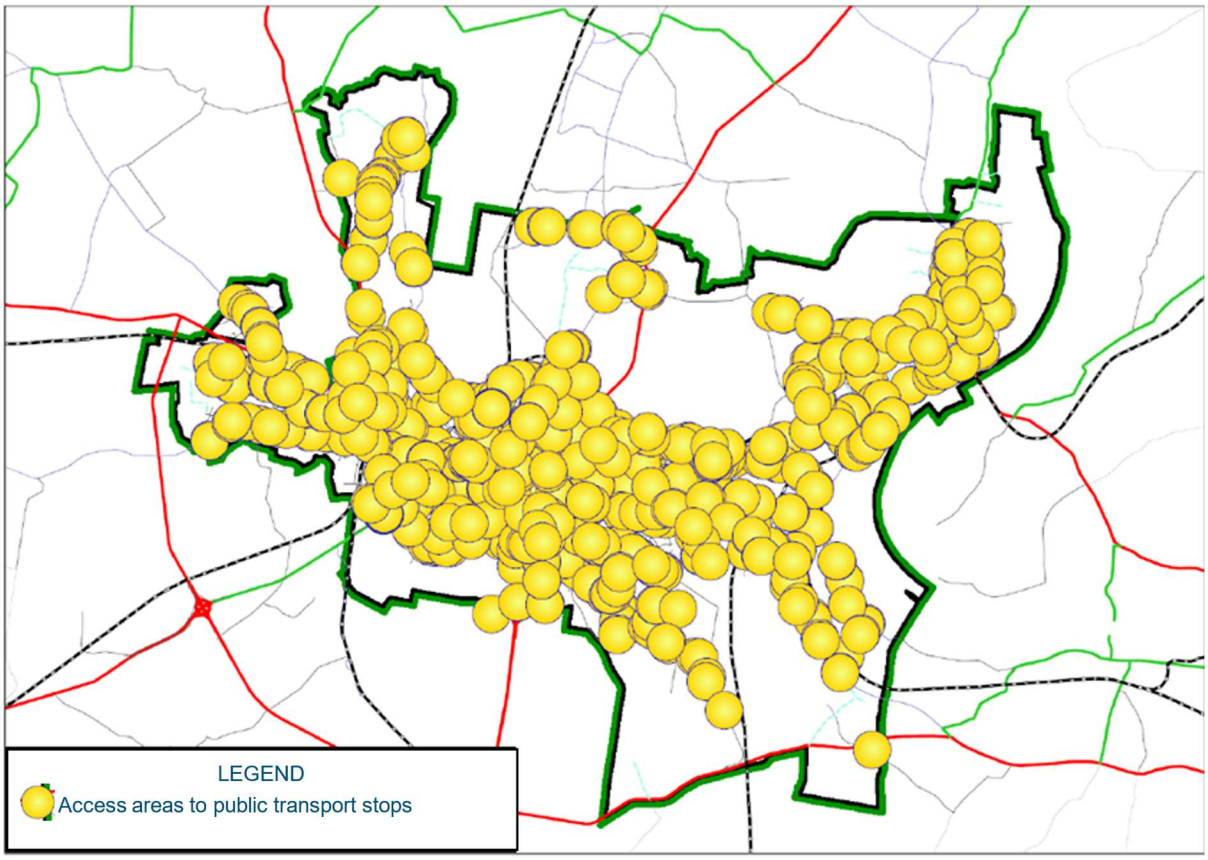


Fig. 2.7. Transport accessibility to public transport services [Study, 2016]

Railway transport

The railway transport network in Bydgoszcz consists of 7 railway corridors along the following currently active railway lines:

- No. 18 – from the west towards Nakło nad Notecią, from the east towards Toruń,
- No. 131 from the northern side towards Gdańsk, from the southern side towards Inowrocław,
- No. 209 eastwards to Chełmża,
- No. 201, in the north-south relation, Gdynia - Nowa Wieś Wielka,

and one line closed for use (no. 356 - westwards to Kcynia). The diagram of these lines is presented in Fig. 2.8. On the other hand, Fig. 2.9 shows the transport accessibility to stops and railway stations in Bydgoszcz, with the assumed acceptable range of passenger service equal to 750 m. The daily number of passengers of regional and interregional rail transport in the vicinity of Bydgoszcz is shown in Fig. 2.10.

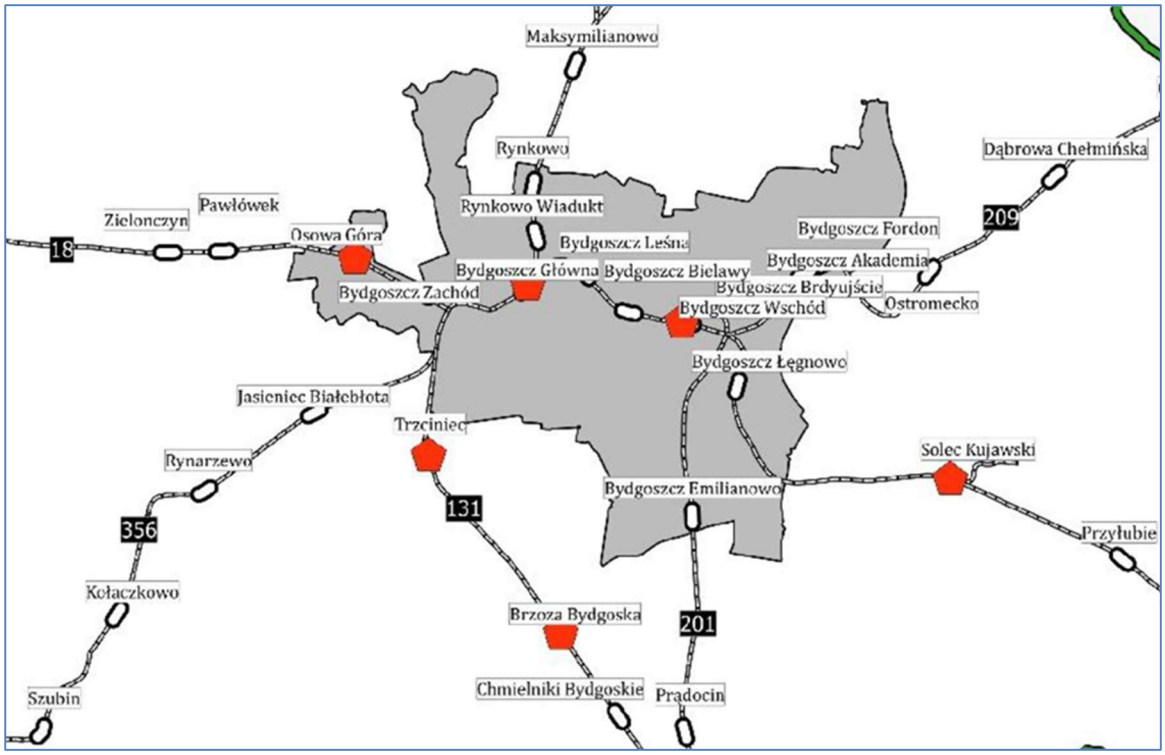


Fig. 2.8. The layout of railway lines in the Bydgoszcz region [Study, 2016]

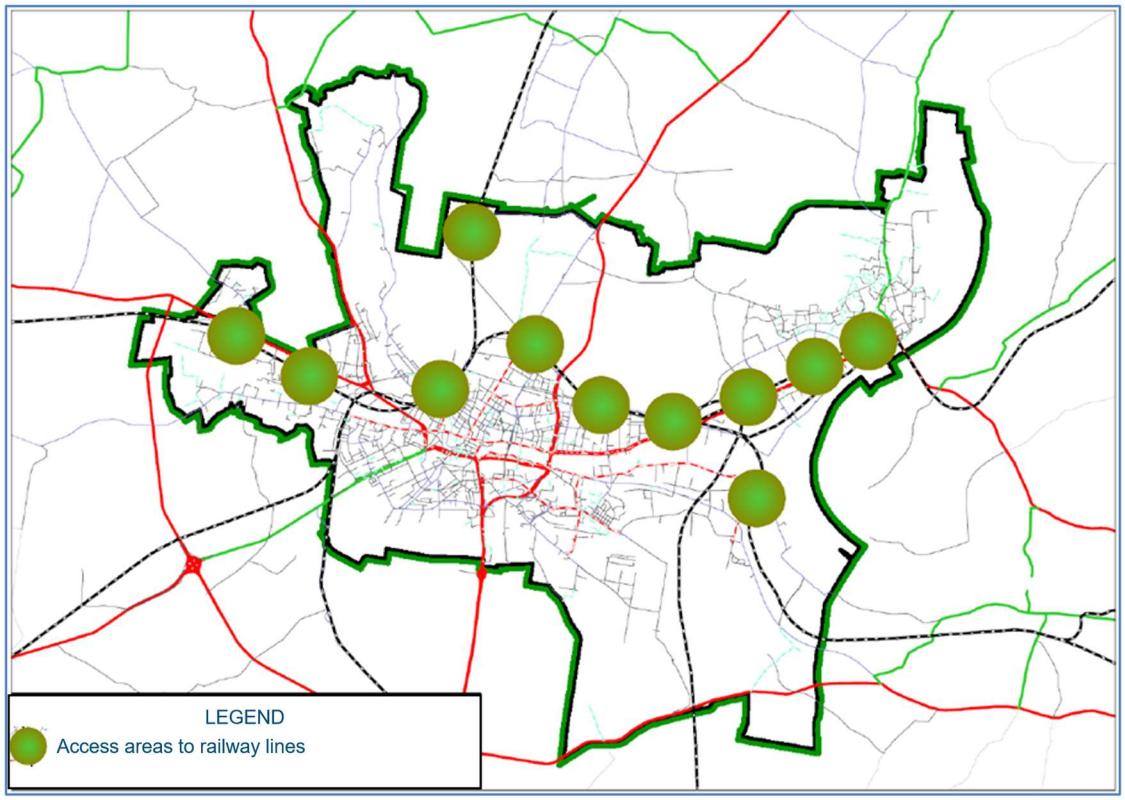


Fig. 2.9. The layout of railway lines in the Bydgoszcz region [Study, 2016]

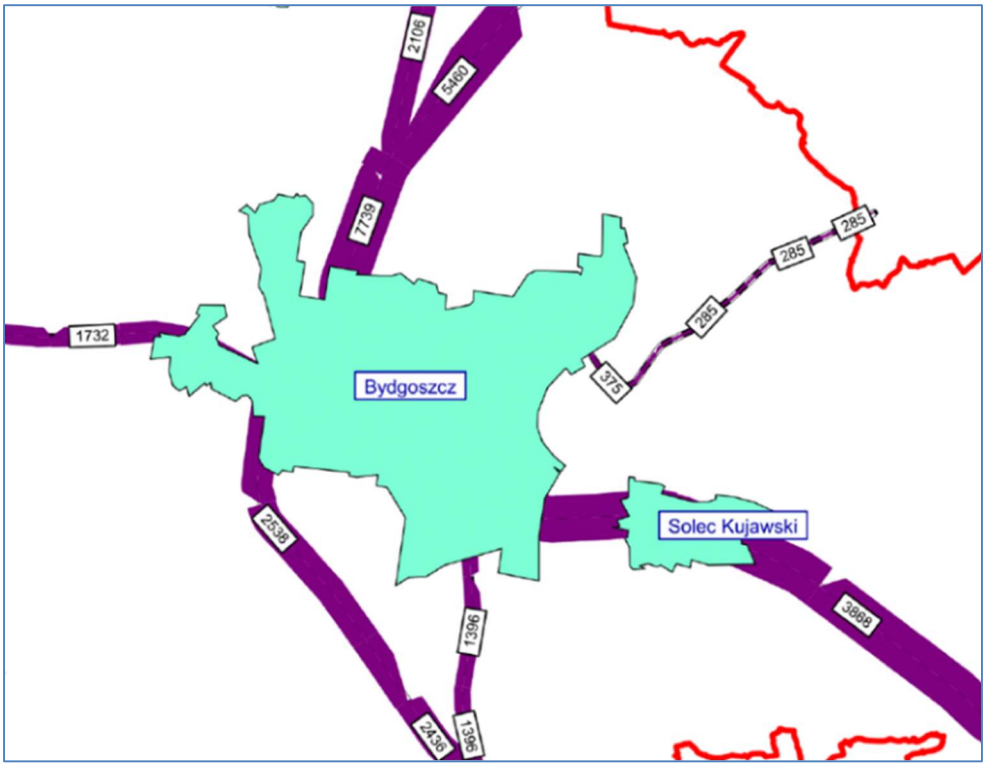


Fig. 2.10. Distribution of daily passenger flows in rail transport on the border of the city of Bydgoszcz [Study, 2016]

Air Transport

There is an international passenger airport in Bydgoszcz. Bydgoszcz airport has a license from the Minister of Transport and Maritime Economy and a certificate "Polish Qualification Certificate" issued by the Chief Inspectorate of Civil Aviation. Over 425 thousand passengers used it in 2019 and compared to previous years it was a very dynamic increase in the number of passengers handled (by as much as ~ 47% compared to 2014). Location of the airport in Bydgoszcz is shown in Fig. 2.11, while the map of its potential impact - in Fig. 2.12.

Fig. 2.11. Location of the International Airport in Bydgoszcz [OpenStreetMap]

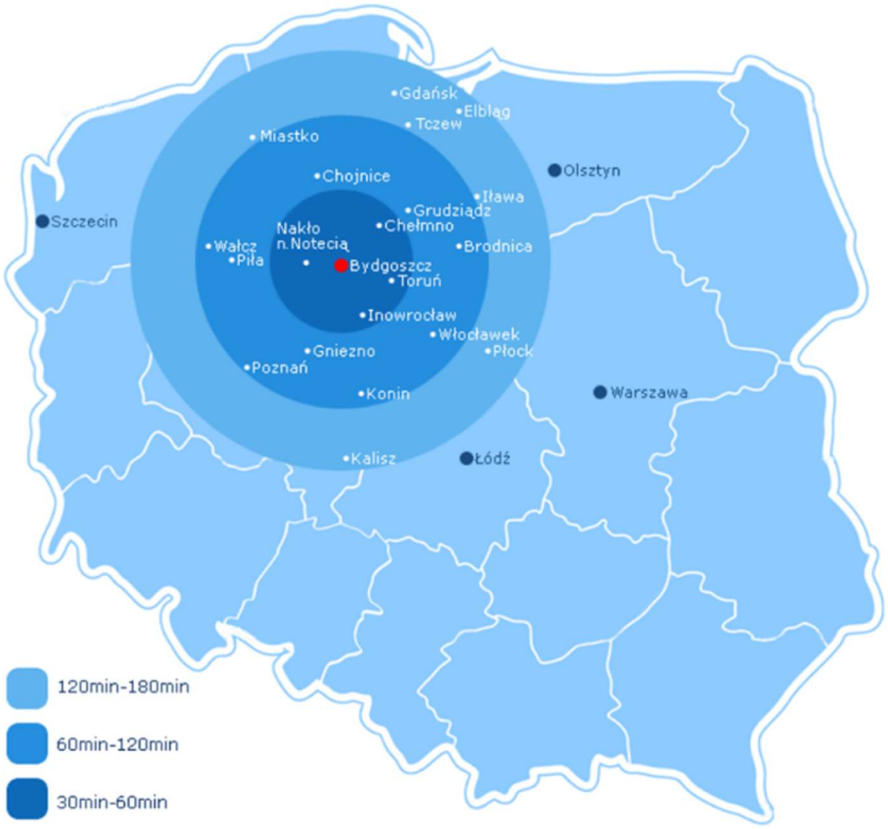


Fig. 2.12. The area of influence of the Bydgoszcz Airport on a national scale [www.plb.pl]

Inland waterway transport

A few water routes run through Bydgoszcz, the course of which is schematically shown in Fig. 2.13. They are primarily the International Waterways (specified in the Regulation of the Council of Ministers of June 26, 2019 on inland waterways):

- The Vistula-Odra Waterway (Kostrzyn nad Odrą - Bydgoszcz), as an element of the E70 road - connecting Rotterdam with Klaipeda, running in Poland along the rivers: Odra, Warta, Noteć, Bydgoszcz Canal - Brda, Vistula, Nogat and Vistula Lagoon to the border with Russia,
- The Vistula Waterway (Bydgoszcz - Gdańsk), as an element of the E40 road - connecting the Baltic Sea with the Black Sea, running in Poland along the Vistula River from Gdańsk to Warsaw and further to the border with Belarus,

and roads of national importance that are part of the Bydgoszcz Waterway (BWW):

- Noteć Górna Trail (Santok - Nakło nad Notecią),
- Górnonotecki Canal,

including roads (trails) of tourist importance in the BWW area:

- Brda Trail (Świeszyno - Bydgoszcz),
- Great Wielkopolska Loop (connecting Bydgoszcz, Konin, Poznań and Gorzów Wielkopolski),
- Toruńska Loop (connecting Bydgoszcz, Elbląg, Ostróda and Toruń),

- Kujawska Loop (connecting Bydgoszcz, Kruszwica, Włocławek and Toruń),
- The Noteć Górna Trail (Santok - Nakło nad Notecią).

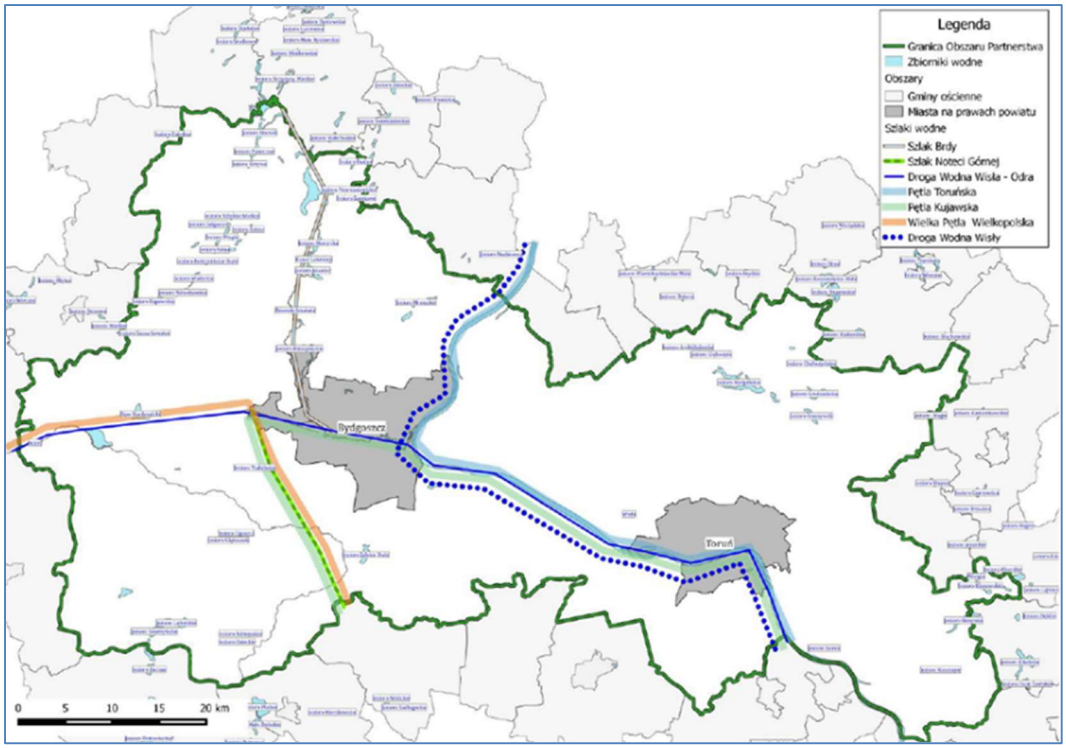


Fig. 2.13. Water routes in the Bydgoszcz region against the background of the metropolitan area [Study, 2016]

In addition, two international waterways intersect in Bydgoszcz. These roads represent a very large development potential for tourism and freight transport. This intersection, together with other watercourses, hydrotechnical facilities and devices, as well as the coastal buildings, constitute a unique area on a European scale, known as the Bydgoszcz Waterway (Bydgoski Węzeł Wodny). It should be added that there is a recreational passenger water transport in Bydgoszcz functioning for many years, known as the Bydgoszcz Water Tram. Courses take place on two lines of communication: Fish Market –Słoneczny Młyn Hotel and Fish Market – Building of the Railway Directorate. Fig. 2.14 shows the range of service of these tourist lines.

Fig. 2.14. Bydgoszcz Water Tram lines operating in 2019 [www.zdmikp.bydgoszcz.pl]

Bicycle transport

The bicycle path network in Bydgoszcz is 85.6 km long and is systematically enlarged every year. The range of bicycle routes in the city is shown in Fig. 2.15. Daily cycling flows in 2015 are presented in Fig. 2.16.

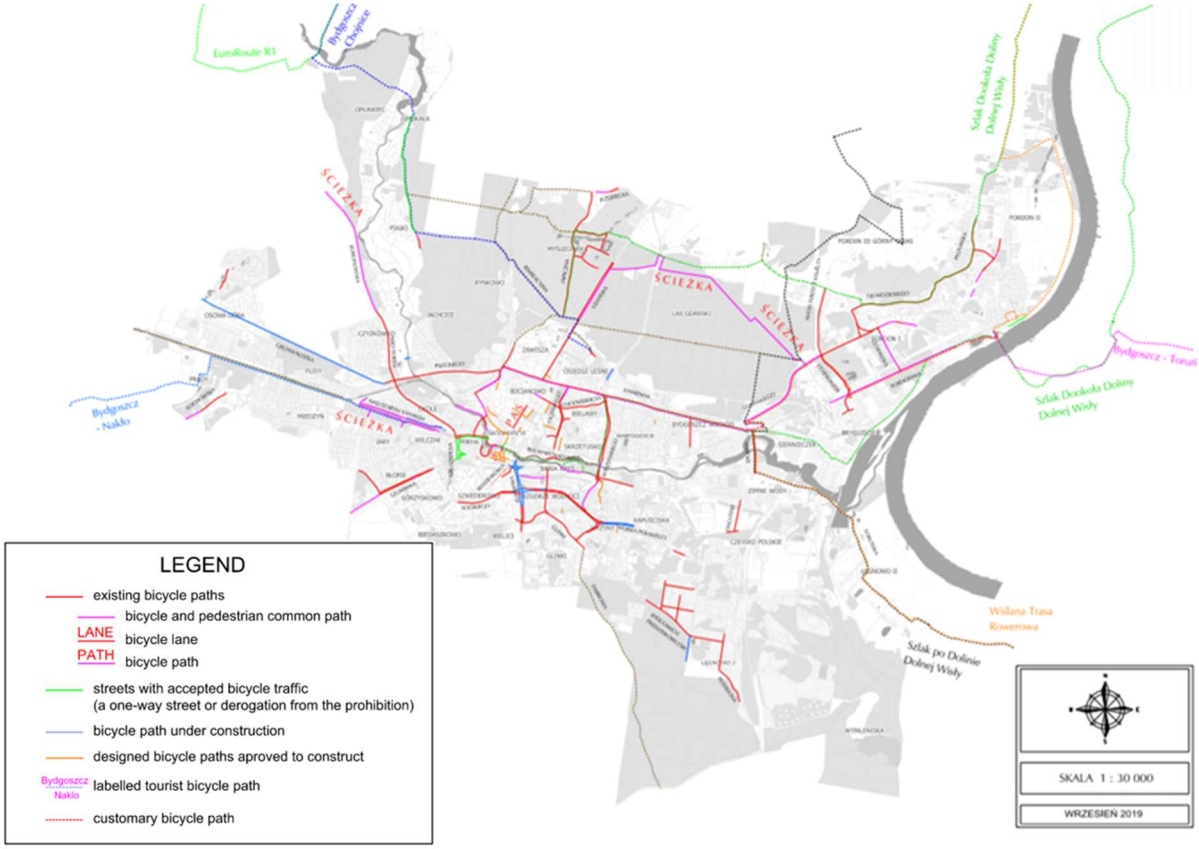


Fig. 2.15. The network of bicycle paths in Bydgoszcz [www.zdmikp.bydgoszcz.pl]

There is a public bike system called Bydgoski Rower Aglomeracyjny (BRA) in Bydgoszcz. It is a network of 51 self-service bike rentals. The stations are located in the city centre and in neighbouring housing estates, as well as in the largest district of Bydgoszcz - Fordon (13 stations). There are 15 places to park bicycles at stations. This means that over 750 public bikes are available for rent on the municipal network. The map of BRA's stations is shown in Fig. 2.17.

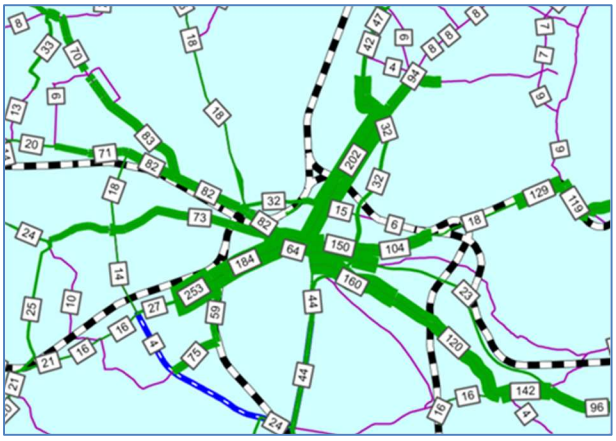


Fig. 2.16. Distribution of bicycle traffic flows on a typical working day in the Bydgoszcz region [Study, 2016]

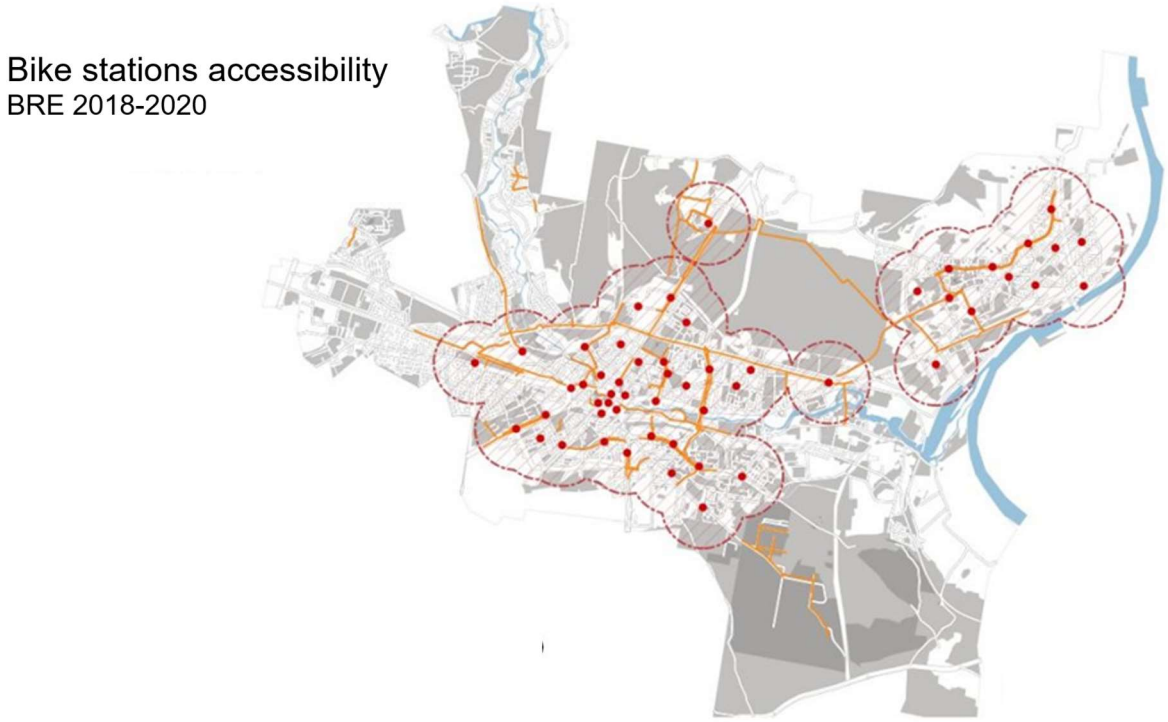


Fig. 2.17. Map of Bydgoski Rower Aglomeracyjny stations along with the impact range of these stations [www.wirtualneszlaki.pl]

There are also 9 marked bicycle tourist routes in the Bydgoszcz region. They consist of the following:

- EuroRoute R1 (international green bicycle route, section in the Kujawsko-Pomorskie Voivodeship)
- The Vistula Bicycle Route (Kujawsko-Pomorskie Voivodeship),
- On the Lower Vistula Valley (black trail),
- Bydgoszcz Airport – Stryszek (black trail),

- Bydgoszcz – Toruń (blue trail),
- Bydgoszcz – Chojnice (blue trail),
- Bydgoszcz – Nakło nad Notecią (blue trail),
- Around the Lower Vistula Valley (green trail),
- Bydgoszcz Myślęcinek – Bydgoszcz Fordon (red trail).

2.2 CHARACTERISTICS OF THE PLANNED MULTIMODAL PLATFROM

This subsection is an excerpt from the document 'Location study for the investment project' entitled: "Multimodal platform based on water, rail, road and air transport with a Logistics-storage centre and a river port located in the indicated area of the left bank of the Vistula River (km 766-771), considering the area of the city of Bydgoszcz and commune of Solec Kujawski" [26]. The study was co-financed by the European Regional Development Fund and budget of the Kujawsko-Pomorskie Voivodeship as well as the City of Bydgoszcz as part of the transnational EMMA project (INTERREG Baltic Sea Region Programme).

The document was developed by WYG International Sp. z o.o. The key objective of the study was to indicate the optimal location for the Multimodal Platform in the analysed area between Bydgoszcz and Solec Kujawski as well as to assess advisability and feasibility of its implementation.

Location and justification for the implementation of the Bydgoszcz-Solec Kujawski Multimodal Platform

The location of the Bydgoszcz-Solec Kujawski Multimodal Platform against the background of the map of Poland and the Kujawsko-Pomorskie Voivodeship is shown in Fig. 2.18.

According to the authors of 'the Study…', the reasons for implementation of the Multimodal Platform are as follows:

- the observed steady increase of transhipment volume in the seaports in Gdańsk and Gdynia,
- the capacity of the existing transport system within the area of the Tricity ports will soon be exhausted; the seaports operate on the basis of rail and road connections, which are already highly overloaded, and their further extension is limited by spatial determinants; in the absence of any alternatives, it will cause significant goods transport problems by both extending the delivery time and increasing the costs, a significant decrease of road safety, a negative impact on the natural environment, as well as the failure to ensure the standards of transport services at satisfactory level;
- the time losses in transport are one of the most important costs incurred by the enterprises operating in Poland; the lack of properly efficient transport system significantly reduces the investment attractiveness of a country, constituting the barrier to entry for foreign companies.

Fig. 2.18 Location of the Multimodal Platform Bydgoszcz-Solec Kujawski on the map of Poland and the Kujawsko-Pomorskie Voivodeship [source: Location study…]

The above-mentioned problems have also a negative impact on the economic development of the Kujawsko-Pomorskie Voivodeship, which constitutes a significant node point for various modes of transport. It is obvious that the lack of transport system links with regard to goods transport and transhipment, adversely affects the effectiveness, efficiency and rapidity of transport of cargo.

The answer to these challenges, according to the authors of the 'Study...', is to be the Multimodal Platform planned in the region of Bydgoszcz and Solec Kujawski. The arguments for its construction in this area is a favorable:

- location of the international waterways E40 and E70,
- location of railway lines No. 18 and 201,
- location of the national roads A1, S5 and the planned S10,
- proximity to large urban centres (Bydgoszcz, Toruń) providing sufficient personnel resources.

Thus, the Multimodal Platform Bydgoszcz-Solec Kujawski will ensure the use of various modes of transport, which will improve the effectiveness of transhipment process not only in the Kujawsko-Pomorskie Voivodeship.

The analyzes carried out as part of the 'Study...' allow the planned location of the Bydgoszcz-Solec Kujawski Multimodal Platform to be considered convenient.

Main assumptions for implementation of the Multimodal Platform Project

The project assumes to achieve the main assumptions, which are as follows:

- commercial and industrial zoned area of the Vistula Waterway (these actions are consistent with the plans and government policy, which is specified in the document “Assumptions for the Development Plans of Inland Waterways in Poland for 206-2020 with 2030 Perspective” adopted by the Council of Ministers on June 14, 2016),
- increase of transhipment volume of goods transported by the inland waterway transport,
- diversification of opportunities in the transhipment and transport of goods,
- integration of various modes of transport as part of one transhipment and storage platform,
- development of a new economic specialization for the region.

The authors of the 'Study...' also indicated basic guidelines for organization of the Bydgoszcz-Solec Kujawski Multimodal Platform, namely:

1) The planned Multimodal Platform should be characterized by a comprehensive, logistical approach to the provided transport services, aiming at optimizing the whole transport chain and offering a wide range of services related to the handling of cargo (e.g. customs services, warehousing services, sorting and completing consignments), in order to increase the effectiveness and reduce the transport costs.
2) Considering the location at the intersection of the international waterways E40 and E70, in the longer term, the planned Multimodal Platform has a chance of a status of hub port, therefore, it is important to secure appropriate areas for its development.
3) Regard shall be had to water level fluctuations in the Vistula river and the port should be protected with the lock in order to enable the functioning of the Multimodal Platform Bydgoszcz-Solec Kujawski.
4) The port quays should be linked with the railing siding in order to directly shift the transhipment from vessels to trains.
5) The Multimodal Platform should enable the transhipment of various goods: bulk goods, general cargo, pallet goods, oversize, and liquid goods. Considering current and long-term trends in goods transport, the forecasts of transhipments as well as the drive towards standardisation of solutions reducing the transport costs, it may be pointed to the need of universalisation of the port's operations without focussing on specific groups of goods.
6) A well-organized service facility will also allow ensuring the functioning of the Multimodal Platform outside the river navigation period. In this context, it is important to ensure the possibility of transhipment in the rail – road transport and intra-industry transport schemes, which do not depend on external factors resulting from climate conditions to such an extent.
7) The Multimodal Platform should use technical and IT communication solutions enabling the services of the 3PL and 4PL providers, including but not limited to database systems, transhipment devices managing systems, storage and warehouse area managing systems, dangerous cargo handling systems, cargo electronic booking system, digital data transmission.
8) The implementation of green technologies and basing the operations on the principle of sustainable development is valuable from the point of view of the operations pursued by the Multimodal Platform. The use of wind or hydro energy should be preferred. With this solution, it is possible to reduce pollution emission and noise during the port's operations.
9) Amount of expenditures necessary to carry out the investment in port infrastructure determines the need to develop effective financing models. It is possible to obtain the EU financing, but it may exceed the capabilities of local government units to make own contribution. Cooperation of several entities, also of various levels, could be a solution. It is also possible to ensure the participation of a private entity, but according to the example of other ports, it is suggested that public entities should play a decisive role.

10) In the case of low popularity of inland navigation and low awareness of transport market users about advantages and opportunities related to its use, an important action involves the effective promotion of this mode of transport. These actions should also involve the state, without the participation of which the development of the inland waterway transport will not be possible to a wider extent.

Analysis of demand

The analysis of demand for the Multimodal Platform was based on the characteristics of various transport aspects, i.e. time, distance costs, loading and unloading as well as the imposed reloading, etc. for different transport segments (rails, roads, waterways) from foreign sources, but adjusted to the Polish reality. This allows determining the effectiveness and competitiveness of particular modes of transport. Based on differences in the economic cost of various types of transport, the possible shifts were also determined. Due to the long distance and the limited cost of water transport, it was the water transport that proved to be the most cost-effective alternative to the existing and forecast rail and road transports.

It was assumed that the full use of transport and transhipment potential of the Multimodal Platform will be only possible if the specified functional assumptions are fulfilled, which primarily include the availability of waterway, length of navigation season and modernisation of the river fleet. Therefore, the forecast of transhipment is divided into stages.

The construction of the Multimodal Platform is planned for 2025-2027 (the final period of the construction works (2027) provides for partial functionality of the Platform, during the construction period of the river port). The years 2028-2035 constitute the first stage of the Platform's operations, at which the waterway navigability will be improved from the class II to the class III. Simultaneously, the fleet enabling the cargo transport from/to the port of Gdynia will be upgraded. After 2045, as a result of full cascading of the Vistula river, the waterway navigation parameters will be improved to the class IV enabling the navigation of the largest transport vessels, whilst extending the navigation season up to 292 days. The forecast transhipments (tab. 2.1) show that the construction of the Multimodal Platform in the indicated location is advisable since they will be over one million tonnes at the first stage of functioning.

Table 2.1. Forecast of transhipments for the Multimodal Platform Bydgoszcz-Solec Kujawski [source: Location study…]

	2017	2027	2028	2035	2040	2045	2055
Mass dry goods [tons/year]	0	332	529,009	802,247	841,271	1,073,170	1,156,885
Conatiners [tons/year]	0	1,750	591,574	996,190	1,098,325	1,428,362	1,648,514
Rest (general cargo) [tons/year]	0	446	42,951	79,654	85,692	110,682	123,762
Overall dimensions [tons/year]	0	12,849	13,084	14,536	15,397	16,104	17,408
Total [tons/year]	0	15,377	1,176,618	1,892,627	2,040,685	2,628,318	2,946,569

Analysis of local determinants

The local determinants were verified as part of the interdisciplinary analyses carried out in the subject 'Studium…'. Their objective was to determine the optimal location of the Multimodal Platform, considering navigation, hydrological, hydrotechnical, geological, environmental, spatial, and legal factors. The key findings of the analyses are presented below:

- Navigation analysis – the planned construction of the Lower Vistula River Cascade, which enables to meet the conditions for the navigation specified for the International Waterway E40 in the AGN Convention2 , i.e. achievement of the navigation class IV will be necessary.
- Hydrological analysis – it was aimed at describing the hydrological conditions in the area of the planned construction of the Multimodal Platform in terms of its connection to the waterway through the port canal. Very favourable conditions for the location of a river port there were found.
- Hydrotechnical determinants – the objective of the hydrotechnical analysis was to verify the potential area of the investment in terms of occurrence of hydrotechnical structures and objects, assess their existing conditions, as well as identify the possibility to locate the port structures and devices there as part of the Multimodal Platform. The area between the flood embankment and Toruńska Street connecting Bydgoszcz with Solec Kujawski is the drained area covered by a dense network of drainage ditches. The indicated area demonstrates a range of favourable conditions in terms of locating the Multimodal Platform there. Its size allows preparing an appropriate concept of the project considering also areas for the future development.
- Geological determinants – the soil conditions may be considered as favourable and demonstrating underground stability within the analysed area. However, given the specificity of the planned investment project, it will be necessary to identify the geological and geotechnical conditions in detail at next stages of the investment, since it will constitute a key factor determining the effective and safe implementation of the investment.
- Environmental analysis – However, the amount and quality of data prevent assessing whether such impact will be significant and whether or not it will be required to design mitigation or compensatory measures. The biggest impact on the protected areas will be within the inter-embankment, where it is planned to construct the entrance canal to the port. Thus, at this stage, there are not any prerequisites preventing the possibility to implement the project due to a potential negative impact on the natural environment.
- Analysis of spatial and infrastructural determinants – an insignificant degree of area urbanisation allows locating the Multimodal Platform Bydgoszcz-Solec Kujawski in the analysed

area. The potential location of the Multimodal Platform Bydgoszcz-Solec Kujawski has possibilities to be connected to the national road system through the existing voivodeship and poviat roads. The existing condition of the road infrastructure in the region of the planned investment does not allow using it for the purposes of road transport related with the operations of the Platform, except for the national road no. 10 and poviat road no. 1547C (Nowotoruńska Street). The other roads are in poor technical condition. The extension of the national road no. 10 to the parameters of the expressway (S10) is planned. After the extension, the point providing the connection of the Multimodal Platform to the national road system will be the junction along the S10 expressway – Bydgoszcz Makowiska. In the future, the primary road system serving the Multimodal Platform may form the existing poviat road no. 1547C and Nowotoruńska Street. The roads leading directly to the Platform, the planned new road parallel to Płątnowska Street and poviat road no. 1546C should complement the primary transport system. The road layout in the area of the investment - the existing conditions and determinants resulting from the planning documents are presented in Fig. 1.19. Within the analysed area, two railway lines, to which it would be possible to connect the Multimodal Platform, were identified. They include the railway line no. 18 Kutno – Piła Główna and railway line no. 201 Nowa Wieś Wielka – Gdynia Port. It is recommended to connect to the switch head of the Solec Kujawski Railway Station, because it is not necessary to build many engineering structures and interfere with the local development.

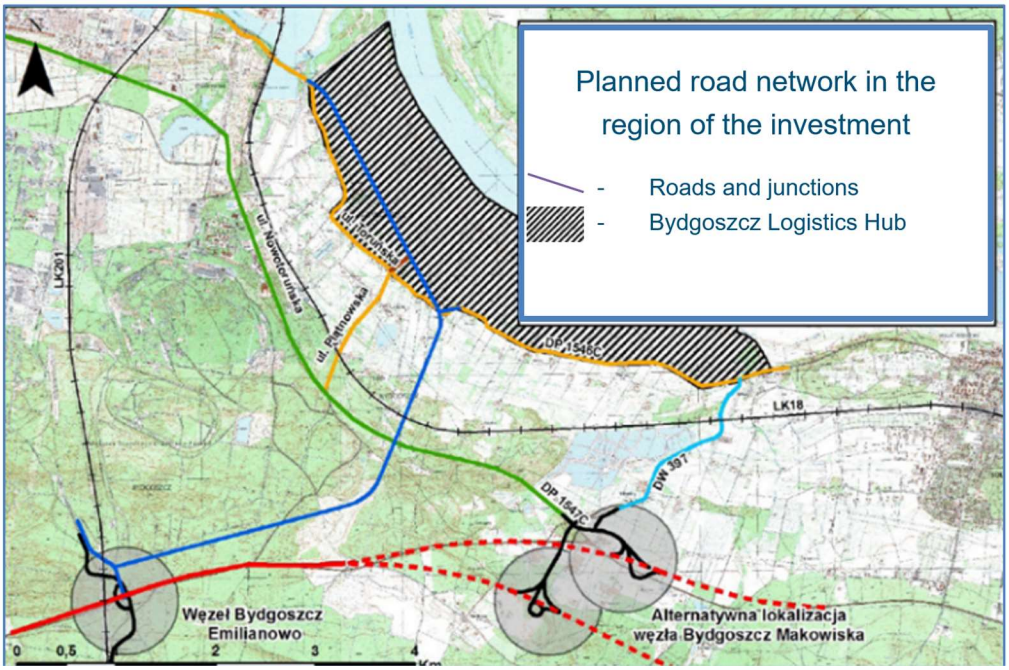


Fig. 2.19. Road System in the Region of the Investment – Existing Condition and Determinants Resulting from the Planning Documents [source: Location study…]

- Analysis of formal and legal determinants – it will be required to change the use of land into the use for non-farm and non-woodland purposes as well as their exclusion from production, amendments to the conflicting area development plans and adopting a new local area development plan for the area covered by such plan or obtaining a decision on the location of a public interest investment. Within the analysed area, there are monuments entered into

the register of immovable monuments kept by the Kujawsko-Pomorskie Voivodeship Monument Conservator and the monument registers for the city of Bydgoszcz and commune of Solec Kujawski. Except for the aforementioned monuments, there are also the "W" archaeological protection zones. Within the "W" archaeological protection zone, the investment activity must be preceded by archaeological surveys, and earthwork requires arrangements with the Voivodeship Monument Conservator.

- Area availability – the area of 265 ha was deemed suitable for the construction of the Multimodal Platform (after considering the necessary buffer separating the planned Multimodal Platform from the existing development, the available area covers 212.1 ha). The estimated area availability is sufficient for the construction of the Multimodal Platform Bydgoszcz-Solec Kujawski, it also leaves a sufficient area for its further development.

Location variants of the multimodal platform

Three variant locations of the Multimodal Platform Bydgoszcz-Solec Kujawski have been developed. As part of the identification of variants, in the first place, the possible port entries, on which the location of the Platform depends, have been designated. It is assumed that each variant shall be connected to the national road system through a new road directly from the Multimodal Platform to Nowotoruńska Street/poviat road no. 1457C, which goes straight to the designed Bydgoszcz-Makowiska junction (the planned S10 expressway). The connection to the national rail system shall be provided by the railway line no. 18 between the level crossing on the voivodeship road no. 397 and the Solec Kujawski Railway Station.

In order to select the optimal variant of the three proposed, the multi-criteria analysis of variants was carried out. The criteria adopted for the analysis were determined on the basis of the interdisciplinary analyses. The selected variant was characterized by:

- area availability for further development of the Multimodal Platform,
- advantageous location of port entry,
- the highest scoring in the most important criteria: hydrological and environmental,
- insignificant impact on Natura 2000 sites.

Figure 2.20 shows the concept of area development of the Multimodal Platform for the optimal variant.

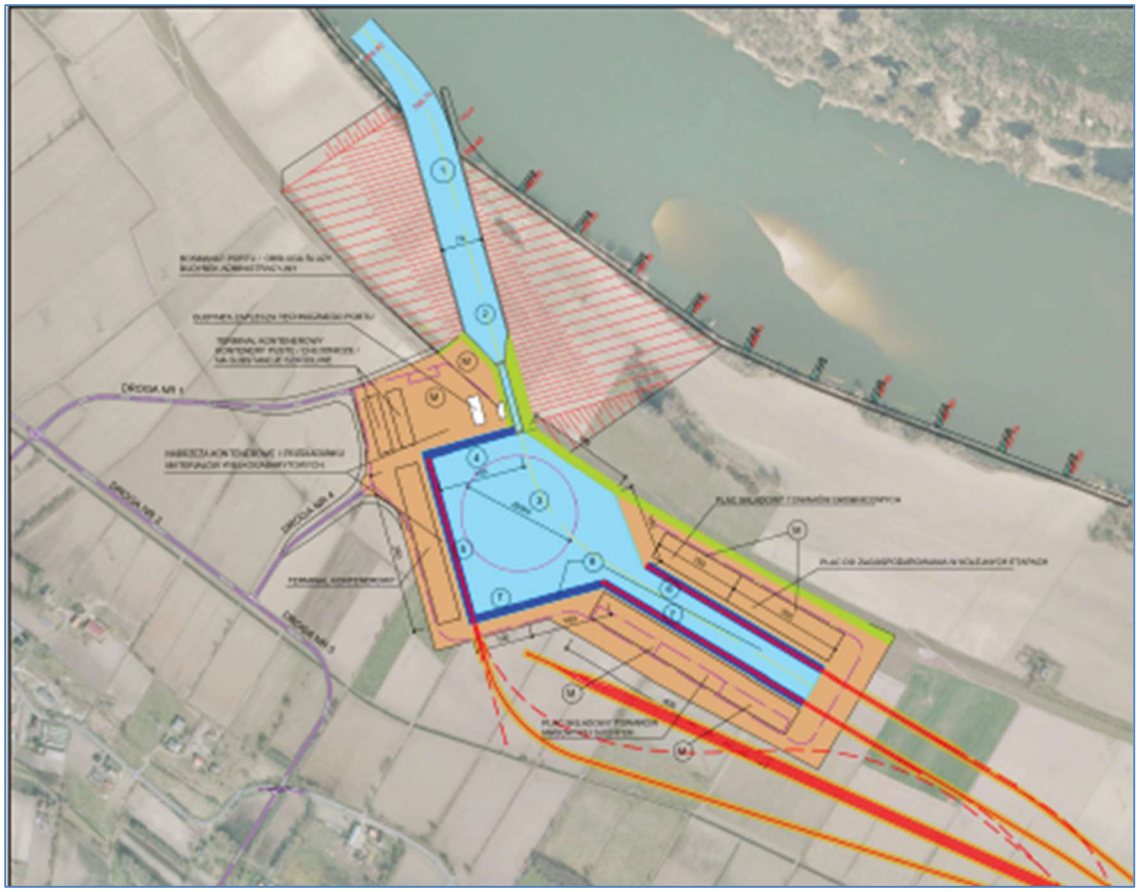


Fig. 2.20. Concept of area development of the Multimodal Platform for the optimal variant *2.*

Construction costs of the multimodal platform and its effectiveness

The construction costs of the Multimodal Platform are presented in Table 2.2, for the most advantageous variant, considering the stages of its construction.

Table 2.2 The construction costs of the Multimodal Platform (net PLN) [source: Location study…]

Trade	Phase I (2025-2027)	Phase II (2035)	Phase III (2045)
Hydrotechnic	713,240,041		
Navigation	38,000		
Railway network	78,700,000	43,089,000	14,767,500
Road netowrk	119,300,000		16,800,000
Environment	1,623,000	100,000	50,000
Plumbing	29,732,800		
Electric power	3,127,000		
Cubature objects	7,824,000		
Total	953,584,841	43,189,000	31,617,500

In 'Study...', in the chapter financial and economic effectiveness of the discussed investment project, it was stated that the project is not commercially viable. The obtained financial ratios for all financing models (public-private partnership, debt financing, hybrid project) assume negative values. This limits the possibility of financing the construction of the Multimodal Platform by funds from the financial market and highlights the need to search for other financing sources, e.g., grants.

On the other hand, the planned construction of the Multimodal Platform will generate a number of economic benefits, significantly exceeding the investment costs. This means that the construction will be viable in social and economic terms. A high economic viability of the investment project is confirmed by the results of the analysis of economic effectiveness ratios, of which all exceeded the assumed reference values. The most important economic benefits as a result of the investment project implementation include:

- Transport costs savings for cargo owners related to significantly lower cost of water transport as compared to road and rail transport,
- Road accident costs savings,
- Climate change costs savings connected with the emission of greenhouse gases caused by road transport,
- Noise costs savings emitted by road and rail transport as well as caused by road congestion.

Furthermore, the Multimodal Platform Bydgoszcz-Solec-Kujawski will bring the number of non-valuable benefits (which may not be expressed in cash). The most important benefits may include the increase of employment in the impact area, as well as the economic growth resulting from the implementation of the investment. The development of areas, which have not been used for the time being or used to a marginal extent, will give new aesthetic qualities to the area covered by the investment project. The construction the logistics-storage centre will generate the demand for additional services, which may translate into further development of entrepreneurship, and in consequence will enhance quality of life.

2.3 ROAD AND RAILWAY TERMINAL EMILIANOWO[2]

There are many reasons for locating the intermodal terminal in Emilianowo, including:

- railway line No. 201,
- the lower section of the Vistula,
- large railway and road junction,
- cargo airport,
- Bydgoszcz Emilianowo station with a well-developed track system,
- distance from the functioning network of ports and terminals,
- large industrial center (former Zachem Chemical Plant),

[2] Based on Szaciłło L., Zielaskiewicz H .: Rozwój przewozów intermodalnych w województwie kujawsko-pomorskim na przykładzie projektu budowy terminala intermodalnego w Emilianowie Przegląd komunikacyjny nr 12/2019, rocznik LXXIV

- developed government programs supporting the construction of multimodal terminals, including: Strategy for Responsible Development until 2020 (with a perspective until 2030), or Assumptions for the development plans of inland waterways in Poland for 2016-2020 (with a perspective up to 2030).

Polskie Koleje Państwowe S.A. (Polish State Railways) own a property in Emilianowo with an investment area of approximately 5.6 ha, which they plan to allocate for the construction of an intermodal terminal. The real estate is located approx. 9 km from the centre of Bydgoszcz and adjacent to the south-east border of Bydgoszcz and the industrial and technological park. The plot is crossed by the railway line No. 201, the so-called coal main. The area has access to public roads: i.e. provincial road No. 274, national road No. 10 runs in the vicinity, and the distance from the A1 motorway is 45 km. The construction of the S10 expressway is also planned, in place of the national road No. 10, with a road junction in Emilianowo.

The project to build an intermodal terminal in Emilianowo is planned to be conducted in several stages:

Stage 1

It includes the construction of a vehicle maneuvering and storage area of approx. 15.495 m^2 along with drainage system, construction of auxiliary infrastructure such as petrol station, transformer station, lighting, fencing, video monitoring, water and sewage, electrical and telecommunication networks. At this stage, it will be possible to carry out loading and unloading works from the railway track closest to the planned manoeuvring and storage area.

Stage II

It includes anextension of the maneuvering and storage area of approx. 4.165,00 m^2 along with drainage system and construction of auxiliary infrastructure such as office and social building, service shed, lighting, fencing, video monitoring, water and sewage, electrical and teletechnical networks.

Stage III

The maneuvering and storage area will be enlarged by another 5.100.00 m^2 along with the addition of auxiliary infrastructure on external land adjacent to the investment site on the eastern side.

On the surface of the terminal slab, 40 'universal containers, 40' refrigerated containers (reefers) and 40 'containers with dangerous goods can be stored. The containers will be moved between rail transport, road transport and the storage area by means of reach-stacker handling devices.

It has been assumed in the construction of an intermodal terminal in Emilianowo that the target volume of transshipments will be 80.000 UTI per year (Unite de Transport Intermodal, i.e. an intermodal loading unit; it applies to rail transport - container, swap body or semi-trailer, regardless of size and dimensions).

It should be noted that the spatial development plan for the Kuyavian-Pomeranian Voivodeship includes plans for the construction of an intermodal terminal in Emilianowo. The Bydgoszcz Emilianowo railway station and the adjacent land have been "excluded" from the Toruń-Bydgoszcz Basin Protected Dunes Area (20 ha in the Bydgoszcz commune, 125 ha in Nowa Wieś Wielka).

3 DESCRIPTION OF TRANSPORT RESEARCH

3.1 TRAFFIC RESEARCH

The research of the characteristics of traffic was carried out in order to determine the size and structure of this traffic on the city's road network and to create a basis for calibrating the developed transport demand model taking into account the freight traffic.

The research included the determination of the following features of traffic:

- volume;
- type structure of vehicles (in defined groups: passenger cars and vans; trucks, lorries with a trailer or semi-trailer, buses, slow-moving vehicles; motorcycles, bicycles);
- directional structure.

The research of car traffic consisted in determining its characteristics in selected measurement sections on the city road network. The measurements were carried out with the use of automatic measuring devices of the Viacount II type, which were installed near the measuring cross-section on fixed elements of the road infrastructure.

The traffic counts were carried out on 10 selected (especially for the purpose of the research) cross-sections of the city's road network, and their list is presented in table 3.1. On the other hand, the location of the measurement points is shown in Fig. 3.1.

Other information on traffic characteristics obtained from various sources is described in item 3.3.

On each of the above-mentioned sections, daily traffic measurements were performed on a selected, average working day (Tuesday, Wednesday or Thursday). Traffic features were recorded automatically. The obtained data (entered into the appropriate measurement forms) were used to calibrate the transport demand model for the existing state.

Table 3.1 List of measuring points in Bydgoszcz

NO.	NAME OF THE MEASURING SECTION	DETAILED LOCATION	DATE OF MEASUREMENT
1.	Koronowska St.	at the interface with Siedlecka St.	25.02.2020
2.	Rudolf Modrzejewski Bridge	in front of the bridge on the north side	20.02.2020
3.	Fordońska St.	at the interface with Wyszogrodzka St.	18.02.2020
4.	Toruńska St.	between Wypaleniska St. and Przyłubska St.	26.02.2020
5.	Jana Pawła II St.	at the interface with Wąbrzeska St.	03.03.2020
6.	Przemysłowa St.	behind the intersection of Dźwigowa and Pod Wiaduktem	19.02.2020
7.	Wyszogrodzka St.	before the intersection with Fordońska St.	13.02.2020
8.	Grunwaldzka St.	at the interface with Św. Antoniego z Padwy	27.02.2020
9.	Pomorski Bridge	bridge	04.03.2020
10.	Nakielska St.	at the interface with the flyover	13.02.2020

Fig. 3.1 Location of measurement points in Bydgoszcz [own study based on Google Maps].

3.2 TRANSPORTATION SURVEY

In order to build a transport demand model for freight traffic for the existing and forecasting state, it was necessary, in addition to carrying out research on car, van and truck traffic and analyzes of its spatial distribution, to obtain information about the characteristics of freight traffic in the city. he communication survey was conducted in enterprises that operate in Bydgoszcz and at the same time may be potentially interested in movement of goods through the planned intermodal ports in Bydgoszcz. The selection of enterprises and their list is presented later in this study.

The survey was carried out through a direct interview with the interviewer and the respondent using several methods of contact: face-to-face, telephone conversation and via remote Internet systems, such as Skype, MS Teams, ZOOM and others. The interview in the company was conducted from 29/06/2020 to 21/09/2020 among the staff dealing with transport and logistics.

The questionnaire form consists of three basic parts: a questionnaire for freight traffic in Bydgoszcz for the existing condition; freight traffic surveys in Bydgoszcz for the forecast period and the city map.

In the first part concerning freight traffic in the existing state, it was necessary to obtain information on the characteristics of the size and types of cargo transported in Bydgoszcz, and for this purpose it was necessary to obtain the following information:

1) type of the transported cargo - individual loads have been classified into the following groups: loose materials, construction materials, food, semi-finished products, mixed materials, liquid materials, machines and devices, vehicles, hazardous materials and others;
2) sensitivity of the transported cargo - defined by the following physico-chemical characteristics: insensitive, temperature-sensitive, hazardous material with an indication of the type of cargo, oversized cargo (in terms of: length, width, height, weight), animal transport, time sensitivity (due to durability of the load), the sensitivity of the load due to its critical role in the continuity of production, mechanical sensitivity (vibration, impact, pressure, etc.) and other sensitivity;
3) type of mean/means of transport used to transport a given cargo - defined as follows: truck without a trailer, truck with a trailer, truck tractor with a semi-trailer, specialized vehicles, bowser, specialized vehicles, refrigerator, rail transport, water transport and other;
4) cyclicality of transport of a given type of cargo - i.e. the frequency of transport of a given type of cargo, and the following were distinguished: cyclical cargo transports, seasonal cargo transports, occasional or occasional seasonal cargo transports;
5) transport volume - the volume of cargo transport of a given type expressed in tonnes per year;
6) number of means of transport used to transport a given type of cargo - the number of means of transport used to transport a given type of cargo, expressed in items per year;
7) direction of cargo transportation - indication of whether a given type of goods is imported to the enterprise or exported.

A very important element of the freight traffic survey is to determine the distribution of the transport volume of a given type of cargo in particular time intervals. The analyzes assumed the distribution

of the size of a given type of cargo expressed in the number of vehicles (means of transport) on a monthly, weekly and hourly basis. The freight traffic survey form for the existing condition is shown in Fig. 3.2 (page no. 1) and 3.3 (page no. 2).

Interview id.		Date		Hour		Interviewer	
Company name		Company address		Activities			

FREIGHT TRAFFIC INTERVIEW in Bydgoszcz– existing state

No.	Direction of transport	Cargo type	Cargo sensitivity	Vehicle type	Cyclicality	Volume [t./year]	Number of vehicles [units/year]
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
	1 – Imports 2 – Exports	1. Bulk materials 2. Building materials 3. Food 4. Intermediates 5. Mixed 6. Liquid materials 7. Machines and equipment 8. Vehicles 9. Dangerous goods 10. Other (what?)	1. Insensitive 2. Temperature 3. Hazardous materials 4. Over-sized – length 5. Over- sized – height 6. Over-sized – width 7. Over- weight 8. Animal transport 9. Temporary (load life) 10. Punctuality (continuity of production process) 11. Mechanical 12. Other (what?)	1. No trailer 2. With trailer 3. With semi-trailer 4. Truck tractor 5. Tanker 6. Cold stores 7. Train 8. Water 9. Another (what?)	1. Cyclic 2. Seasonal 3. Occasional 4. Occasional - seasonal		

No.	Monthly distribution [veh./month]												Weekly distribution [veh./day]						
	1	2	3	4	5	6	7	8	9	10	11	12	MO	TU	WE	TH	FR	SA	SU
1.																			
2.																			
3.																			
4.																			
5.																			
6.																			
7.																			
8.																			
9.																			
10.																			

Fig. 3.2. Freight traffic survey – page 1

On the second page of the freight traffic survey for the current state (Fig. 3.3) there is a section on obtaining information describing the journey chain in the transport of particular types of cargo from the source/destination place to a given surveyed company. In this regard, information was obtained about the place and address of storage of goods (defined as land/facility: own, leased, owned by the forwarder or other). In addition to the location of the place of storage of cargo, the interviewers obtained data on the route through which the cargo is transported, indicating the main inlet and outlet routes from the city, as well as the destination to which a given type of cargo is delivered or the source place from which the cargo is transported.

The scope of the freight traffic survey for the forecast state (Figure 3.4 - page 3)) contains information on the types of cargo that may be transported in a given company during the forecast period. Additionally, the questionnaire highlighted the need to obtain information on the assumptions regarding the increase or decrease in the volume of transport of individual cargo groups indicated by the respondents. The respondents were also to determine the possible share of the indicated types of ports (rail, water) in the transport of individual types of cargo, along with information on the acceptable increase/decrease in costs in relation to the current costs of transport using the indicated reloading ports and the acceptable extension/reduction of transport time.

FREIGHT TRAFFIC INTERVIEW in Bydgoszcz– existing state

No.	Daily distribution [veh./h]																						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.																								
2.																								
3.																								
4.																								
5.																								
6.																								
7.																								
8.																								
9.																								
10.																								

Trip chains							
No.	Storage place in Bydgoszcz	Storage address in Bydgoszczy	Route	Intermediate storage addresses in Bydgoszcz	Route	Inlet/outlet road in Bydgoszcz	Trip destination/ source
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
	1. own, 2. lease, 3. at the freight forwarder, 4 – other (what)?						

Fig. 3.3. Freight traffic survey – page 2

Interview id.	

FREIGHT TRAFFIC INTERVIEW in Bydgoszcz– forecast

No.	Direction of transport	Cargo type	Cargo sensitivity	Type of vehicle	Volume [t./year]	Number of vehicles [units/year]	Share of transport by water platform [%]	Share of transport by-railway platform [%]	Accepted increase in transport costs [%]	Accepted increase in transport time [%]
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
21.										
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Can the use of freight tram deliveries in the city be attractive to the company:

Yes	Maybe	I don't know	Definitely not	
Reason				

Additional comments:

Fig. 3.4. Freight traffic survey – page 3

The questionnaire was supplemented with a question about the possibility of using alternative means of transport for deliveries within the city (intra-city) with the use of freight trams by individual companies.

The fourth page of the questionnaire (Fig. 3.5) presents a map of Bydgoszcz, where the interviewers marked the location of cargo storage places and the main directions of cargo movement during their transport (import/export).

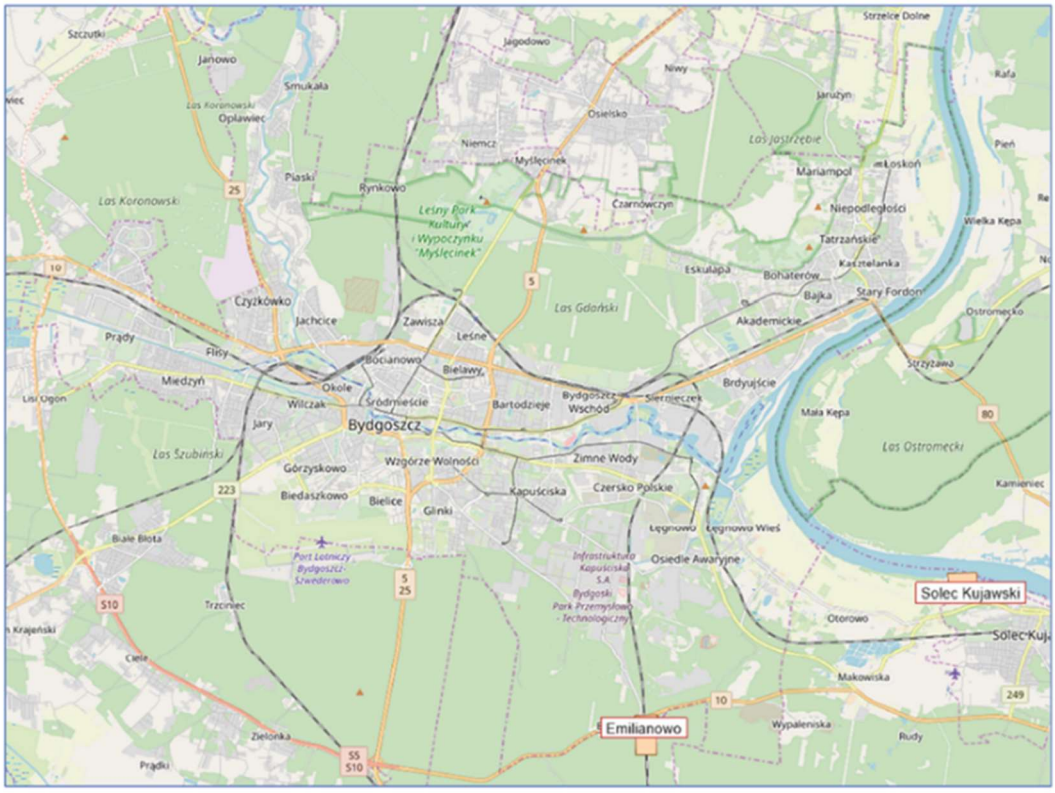


Fig. 3.5. Freight traffic survey – page 4

3.3 DESCRIPTION OF OTHER TRANSPORT RESEARCH RESULTS USED IN THE STUDY

To update and calibrate the Bydgoszcz transport demand model, in addition to the results of the planned research carried out by the authors, many research results and data contained in the following studies were used:

1) Data on the street network and transport in Bydgoszcz: ZDMiKP Bydgoszcz,
2) General Traffic Measurement performed by GDDKiA (National Department of Transportation) on national roads in 2015,
3) General Traffic Measurement carried out by ZDW (County Department of Transportation) in Bydgoszcz on county roads in 2015,
4) A study prepared by the General Directorate for National Roads and Motorways - Archiving and analysis of data from continuous traffic measurement stations of 2018-2020,

Re. 1

ZDMiKP in Bydgoszcz provided the authors with the following data:

- routes of individual streets in the axial system,
- condition and type of surface of individual streets,
- functional division of individual streets,
- traffic light programs,
- measurement data obtained from the Road Administrator from induction loops operating under the ITS project in Bydgoszcz,
- measurement data carried out by ZDMiKP in Bydgoszcz in the last year on the city's road network

Re. 2

The paper uses the results of daily measurements of road traffic volumes made in 2015 as part of the General Traffic Measurement at the following points located on national roads (Fig. 2.6):

- DK 5 point No. 71110, cross-section Osielsko – Bydgoszcz,
- DK 5 point No. 70870, cross-section Bydgoszcz – Przyłęki,
- DK 25 point No. 71011, cross-section Tryszczyn – Bydgoszcz,
- DK 80 point No. 71003, cross-section Pawłówek – Bydgoszcz,
- DK 80 point No. 71207, cross-section Bydgoszcz – Strzyżawa.

The above measurement results were used to determine the inbound and outbound traffic from Bydgoszcz. In addition, in order to determine the traffic growth index for transit traffic, the results of traffic measurements from GPR2005, GPR2010 and GPR 2012 from selected cross-sections of national roads in the Kujawsko-Pomorskie Voivodeship were used.

Re. 3

The study also includes the results of daily measurements of road traffic volumes made as part of the General Traffic Measurement in 2015 at the following points located on voivodeship roads (Fig. 3.6):

- DW 223 point No. 04044 cross-section Bydgoszcz – Białe Błota,
- DW 256 point No. 04098 cross-section Bydgoszcz – Włóki.

The above results were also used to determine the inbound and outbound traffic from the city.

Re. 4

The analysis of measurement results from points on the road network conducted in a continuous mode will allow to calibrate changes in the intensity and structure of car traffic, including truck traffic on the road network. Points located near Bydgoszcz were used in the study.

Fig. 3.6. Location of measurement points for general traffic measurement performed by GDDKIA (National Department of Transportation) and ZDW in Bydgoszcz [own study based on Google Maps]

4 ASSUMPTIONS FOR THE CONSTRUCTION OF THE TRANSPORT MODEL

The contemporary possibilities of conducting analyzes of the functioning of transport systems, both for the current state and for forecasting periods for areas with intensive spatial development, require the use of appropriate IT tools and large computing power. Due to the complexity of transport processes taking place in the transport of people and goods, their high randomness, as well as the interdependence of the method of transport services and travel on the current load status of individual transport networks, the proper reproduction of this phenomenon requires a lot of data describing both the transport demand side and supply (available services) in transport.

The demand for transport results from the natural living needs of the inhabitants, both of the analyzed area (internal and generated traffic) and areas beyond its borders (absorbed and transit traffic). The displacements are a consequence of the natural spatial distribution of natural goods and the distribution of the population, they result from sociological and cultural needs, as well as from productive and social activity of man. Both the transport of goods necessary for production and trade, as well as the movement of people, have accompanied man from the beginning of his existence. The scope of these transport needs is changing (travel motivations, types of transported goods), travel distances and their implementation (e.g. multimodal travel - using various means of transport).

The supply in transport is described by all available transport systems enabling the implementation of the above-mentioned transport needs both in individual and collective journeys of residents and visitors to the area of analysis, as well as the needs in the transport of goods (including raw materials, food, finished products and semi-finished products). As part of the description of supply, it is necessary to define both the transport infrastructure (available transport sections, interchanges connecting these sections and individual transport systems, as well as the conditions and principles of operation of individual transport systems - e.g. timetables for public transport, capacity of transport means).

Bearing in mind the intermodality of transport systems, which means the possibility of providing transport services by various means of transport, as well as the strict dependence of the method of travel on the preferences of residents and the economy and the transport of products depending on their requirements, in model analyzes, it is necessary to use such a transport demand model that will enable the reconstruction of the above phenomena.

It should be noted that each of the transport systems is characterized by its limited capacity, i.e. the maximum number of journeys, weight and dimensions of cargo that can be carried out by a given transport system. An example may be the public transport, in which the maximum number of passengers that can be transported will result from the capacity and number of means of transport at the carrier's disposal, as well as the freight transport, where the weight and dimensions of the load, as well as its susceptibility to damage, have a direct impact on the method of transport. If the demand exceeds the supply, travellers and carriers are forced to use other forms of transport, choose a different destination for a given trip or resign from it, or change the method of cargo transportation.

The reconstruction of the above-mentioned transport phenomenon therefore requires the use of the transport demand model as the simulation one, the task of which will be to recreate transport processes in the analyzed area, considering both the demand and supply sides for transport, as well as the interdependence of these two layers.

At the stage of developing the concept of using the current transport demand model of the city of Bydgoszcz, developed in 2010-2012, its main component layers were separated, which also constitute the foundations of its functioning. The main layers of the model are:

Supply

1) The city road network representing the road infrastructure:
   - linear: road sections with basic technical parameters, including the width of the lane, the number of lanes, speed in conditions of free movement of vehicles for generic groups, capacity, etc.
   - point: road intersections and junctions, network endpoints, locations of public transport stops, places where the road cross-section changes.

2) The city's public transport network representing the road infrastructure:
   - linear: the track network (tram and rail) in the city and the routes of the individual public transport lines,
   - point: stops and loops of public transport.

3) Suburban road network, representing access sections to express roads and multimodal platforms:
   - linear: track (railway) network outside the city borders and road sections;
   - point: places of storing and reloading goods at shipping points and multimodal hubs.

Demand

As part of the transport demand, transport needs were identified, which were carried out by:

1) Resident groups:
   - in the city covered by the analysis and meeting the transport needs within this area (internal traffic);
   - in the city covered by the analysis and meeting the transport needs outside of it - traffic generated by the analyzed area;
   - outside the given area, but meeting the transport needs within the analyzed area - traffic absorbed by the analyzed area;
   - outside the analyzed area and fulfilling their transport needs, outside this area, but through the analyzed area - transit traffic.

2) Transportation of goods related to the current activities of residents and the economy:
   - in the city covered by the analysis and resulting both from the everyday needs of the residents and the current production within this area (internal traffic);
   - outside the city, in areas designated as multimodal ports;

- outside the city as external traffic.

Each trip results from the internal motivations of the inhabitants or the needs of cargo transportation. The range of motivation and goods transported is very large. In individual trips, from trips related to the workplace, through business trips, trips resulting from studying, shopping, visiting, visiting a doctor, office, using services, etc. In terms of the transport of goods, they can be various types of goods (e.g. food, liquids, gases, construction materials), as well as various forms and dimensions of transported goods (as packages, containers, bulk, etc.) and their different transport sensitivity (e.g. in in terms of timeliness or susceptibility to damage). When defining travel motivations in passenger transport, one should remember about the possibility of describing these motivations through the city's attractiveness - to what extent a given city area is attractive for a given group of travel motivations (e.g., for shopping). Therefore, in the analyzes of people's travel, a simplification was introduced, consisting in aggregating certain travel motivations into specific groups of motivations. Despite this, as part of building the model, the scope of available incentives was adopted, extended in relation to the recommendations of the "Blue Book - Infrastructure and Environment". The following travel motivations (goals) were distinguished:

- To home (D)
- To school (S)
- To the university (U)
- To work (P)
- For retail purchases (Z)
- To the shopping center (H)
- In private matters (R) – including visits, recreation, official matters, visits to health centres, etc.

Bearing in mind that the purpose of travel and the manner of travel by the inhabitants of a given area depends both on age, social and professional status, and the means of transport that a given group of residents has, the following groups of people with homogeneous transport behaviour were distinguished:

- Primary and middle school students (USP),
- High school students (USS),
- Students in full-time studies (Stu),
- Working people with a car at their sole disposal (P+S),
- Working people who do not have a car at their sole disposal (P-S),
- Non-working people who have a car at their sole disposal (NP+S),
- Non-working people who do not have a car at their sole disposal (NP-S).

Due to the fact that children under the age of 9 usually do not travel independently, the group "Primary and middle school students" applies only to those who are 9 years old.

In the field of freight transport, a division of transport has been introduced depending on the type of means of transport used for the transported cargo:

- a truck without a trailer;
- a truck with a trailer;
- a truck with a semi-trailer;

- semi-truck;
- bowser;
- cold room;
- railway;
- inland navigation vessels - water;
- other means of transport.

With the demand and supply in transport so defined, the following basic assumptions regarding the functioning of the model were made:

1) The overarching task of the model will be to determine the volume of freight traffic, i.e. supply and truck traffic on the road network of the analyzed area and on direct access to multimodal ports, as traffic directly related to the creation of the above-mentioned multimodal ports.
2) In addition, the model will determine the volume of private car, van and truck traffic as well as passenger flows in individual and public transport (buses, trams, railway, etc.) on the road network of the analyzed area as urban traffic directly influencing the implementation of vans and trucks related to multimodal ports.
3) The transport demand model will be a macromodel, i.e. it will reflect typical transport phenomena in a global system, without detailed analyzes of local phenomena (such as e.g. lane change, joining traffic), which is the subject of microsimulation.
4) In the model, the demand will be generated dynamically for a given time, i.e., a working day.
5) The model of freight travel related to planned multimodal ports will be developed based on the results of surveys carried out among selected companies potentially interested in these ports - e.g. transport companies.
6) The internal city travel model will be based on the theory of the four-stage computational stage consisting of:
   - Demand generation (traffic generation).
   - Choice of destination (spatial distribution of traffic in a matrix system).
   - Choosing the means of carrying out the journey (walking, cycling, etc.).
   - The distribution of traffic on the transport network (selection of travel routes and the load on individual sections of the transport networks).
7) All stages of the calculations will be carried out each time during each calculation cycle, which will make it possible to properly reflect the characteristics of the supply under the traffic load on the network. Thanks to this, the results of simulation analyses will be burdened with less errors.
8) The basis for generating internal demand will be residents assigned to address points defined in the transport demand model on the basis of the population register database (PESEL).
9) The number of trips generated in a given period of time (daily), as well as other necessary model parameters, such as, for example, the average length of the trip, the criterion of selecting the destination, selection of the means of transport, etc., will be carried out on the basis of surveys conducted in 2011-2012.

10) The attractiveness of individual areas of the city, understood as the frequency of potential visits to a given area by residents per unit of time (hour or day of a working day), will be defined on the basis of data and authors' own research on public utility facilities implemented under the above-mentioned works and counts carried out for the construction of the transport demand model of the city of Bydgoszcz in 2010-2012. The data on spatial development will be updated with data on new generation and traffic absorption facilities available at the time of model update (especially large commercial facilities).
11) For the purposes of model analyzes, the existing transport model will be supplemented with new areas representing multimodal ports - new, the so-called transport regions. The basis for defining the contractual boundaries of individual transport regions will be the suggested boundaries of the functioning of the above-mentioned ports.
12) The attractiveness of external transport areas will be adapted to the available results of external traffic research - the intensity of inbound / outbound traffic to the city.
13) Freight traffic (trucks and vans) will be determined based on a separate survey research and expert assumptions of the authors of the transport demand model (based on [10, 14, 15, 16]), as the number of generated and absorbed trips of vehicles of this group from/to workplaces and public utility facilities. Similarly, to the description of the attractiveness of individual areas, the attractiveness for generating/absorbing freight traffic will be assigned to address points.

The German VISUM software (Graphic, Interactive, Transport IT Package) by PTV Vision from Karlsruhe was used as the transport demand model environment. This environment is characterized by the following key features:

- Widespread use in Poland (many local city transport demand models, agglomeration models, county models, as well as the national road traffic model have already been developed in it).
- The possibility of conducting full model analyzes in accordance with the theory of four-stage modelling of transport processes in the field of macrosimulation.
- Script support.
- Possibility of data exchange with other software, including GIS-type environments.
- Google maps support.
- Speed of calculations.
- Possibility to interfere with the software parameters and calculation procedures.
- Ability to define user point of interest database.
- Ability to define user attributes for all objects included the transport model.

The essential idea of the software is presented in Figure 4.7. The aforementioned environment is used for macrosimulation, but the obtained results can be successfully used for more detailed analyzes - microsimulation. The construction of the model makes it possible to export a selected part of the network to the VISSIM software (the software of the same manufacturer). VISSIM is a software designed for the micro-simulation of transport processes, enabling the observation of the functioning of individual elements of the transport network, considering the individual behaviour of individual road users (movements of freight vehicles, operations of these vehicles in the area of loading stations, behaviour of drivers, travellers of public transport, pedestrians, etc.). Thus, it is possible to analyze the effects of changes in traffic organization at individual intersections and inter-junction sections: change

in the directional structure of inlet lanes, introduction of bus lanes, changes in the traffic light programs, etc., as well as changes in the way multimodal ports function.

Such defined assumptions for the model enable the analysis of the effectiveness of several transport investments concerning both freight, individual and public transport, as well as their mutual impact.

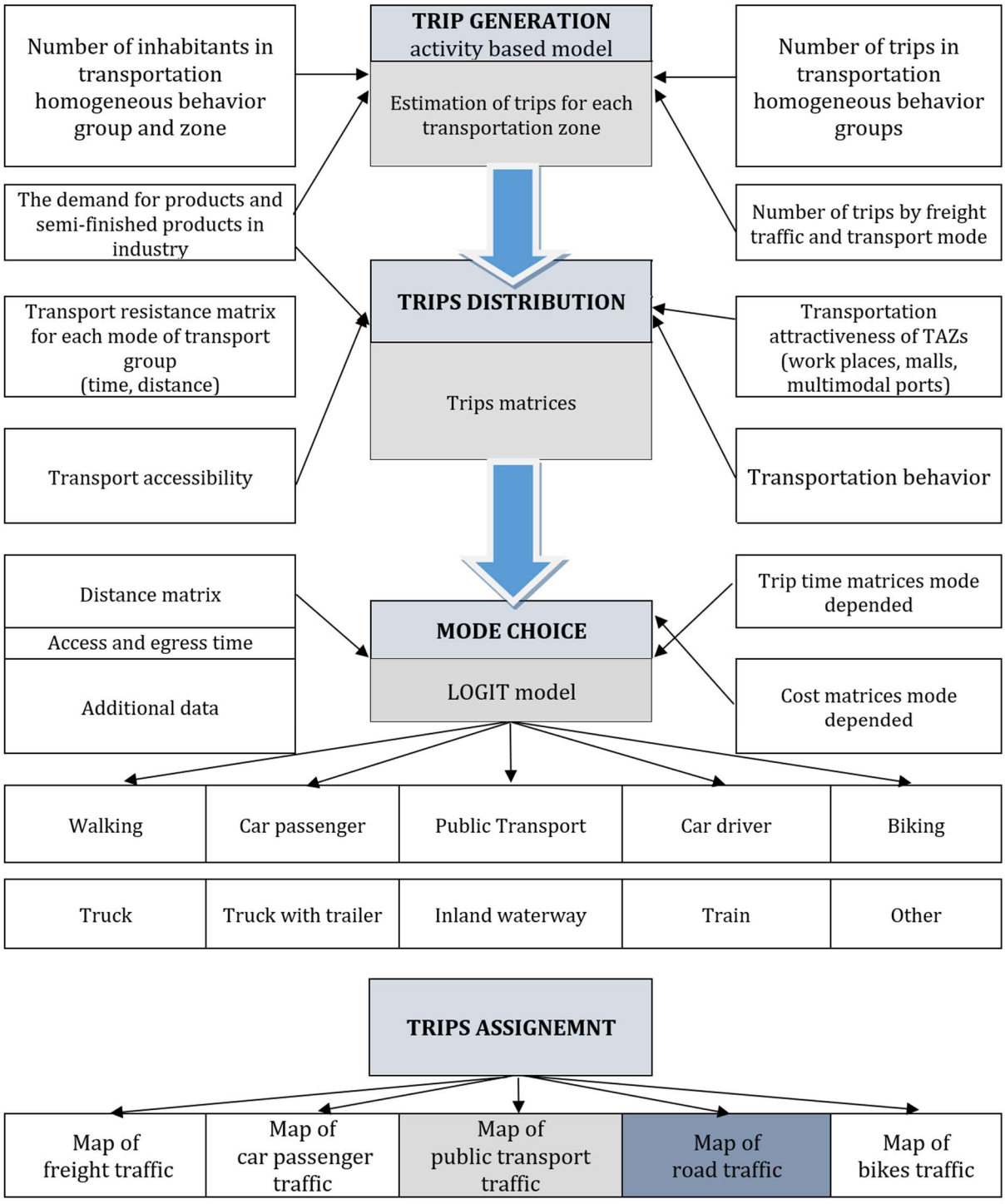


Fig. 4.7. A schematic diagram of building a transport model in the VISUM software [own study]

5 DESCRIPTION OF THE SOURCES AND OBJECTIVES OF THE FREIGHT TRAFFIC FOR INDIVIDUAL MEANS OF TRANSPORT

5.1 REASONS TO DESIGNATE SOURCES AND TRAVEL PURPOSES IN THE CITY

Sources and destinations are the basis for determining the volume of freight traffic on the city's transport networks. In transport analyzes, it is assumed that all journeys take place between the source (journey start) and destination (journey end). Knowing the start point of the journey (where from?) and the end point of the journey (where to?), it is possible to determine potential possible routes of their implementation along the transport network of the analyzed area, and thus the impact of these journeys on the area of analysis. In transport models, journeys take place between the so-called transport regions - areas that aggregate single real sources and destinations (usually buildings) into conventional homogeneous transport areas. Each of the transport regions is characterized by its attractiveness in terms of generating and absorbing both passenger (city residents) and goods travel (resulting from the living needs of the residents and the production activity of the analyzed area). Generation determines the number of journeys commenced in a given transport region, while absorption determines the number of journeys ending in a given transport region. It is assumed that in the case of these analyzes, freight vehicle journeys will take place in both directions, i.e. from the city to the multimodal terminals - transport of goods from the city, and from the terminals to the city - import of goods.

In order to determine the impact of new multimodal terminals on truck traffic in the city of Bydgoszcz, it is necessary to determine the location of new or existing production and transport companies potentially interested in future freight transport with the use of these multimodal terminals. Therefore, it is necessary to introduce new transport attractiveness related to the functioning of these ports in the transport model. Such attractiveness must be assigned to each of the transport regions. This is an additional attribute for describing each transport region. In transport regions where the establishment of new transport and production companies interested in the analyzed multimodal terminals is not expected, this attractiveness will be equal to zero. On the other hand, in other regions, it is necessary to determine the amount of generated and absorbed daily freight transport - the number and type of means of transport moving between the city's internal regions and multimodal ports. Therefore, at the stage of research works, it is necessary to identify which of the currently operating transport and production companies would potentially be interested in using transport services related to the planned multimodal ports. Additionally, it is necessary to define the size and assortment of these transports.

5.2 SELECTION OF ENTERPRISES SELECTED TO CONDUCT A TRANSPORT SURVEY

Correct modelling of the demand for freight traffic, which could take place with the help of intermodal transport, requires precise identification of companies that could be interested in this form of transport. As this type of transport is characteristic for long-distance travel (international and intercontinental) and large amounts of simultaneous transport of goods, it was assumed that only medium-sized (from 50 to 249 employees) and large companies (over 249 employees) operating in the city are companies

that may be interested in intermodal transport. Another criterion for selecting enterprises to conduct a transport survey was the type of activity performed. The analysis took into account (among companies meeting the size criterion): all production companies, all trade companies and service companies dealing with transport, waste disposal, as well as servicing electronic equipment or trucks. Figure 5.1. presents the algorithm used to select the companies selected for the survey.

Information on enterprises came from the databases of the Central Statistical Office and information that can be found on the website of the Bydgoszcz Regional Development Agency, which has information on the 1.117 largest companies operating in Bydgoszcz and the region. After the initial selection of enterprises selected for the survey, the analysis of these establishments was made mainly on the basis of data contained on the websites of these entities. The analysis consisted in finding out by an experienced analyst in the field of truck traffic modeling, whether a selected company may be interested in using intermodal transport. The person conducting the analysis relied mainly on data related to the size of the company and the type of goods imported or exported by a given company. The final list of enterprises selected for the transport survey is presented in Table 5.1.

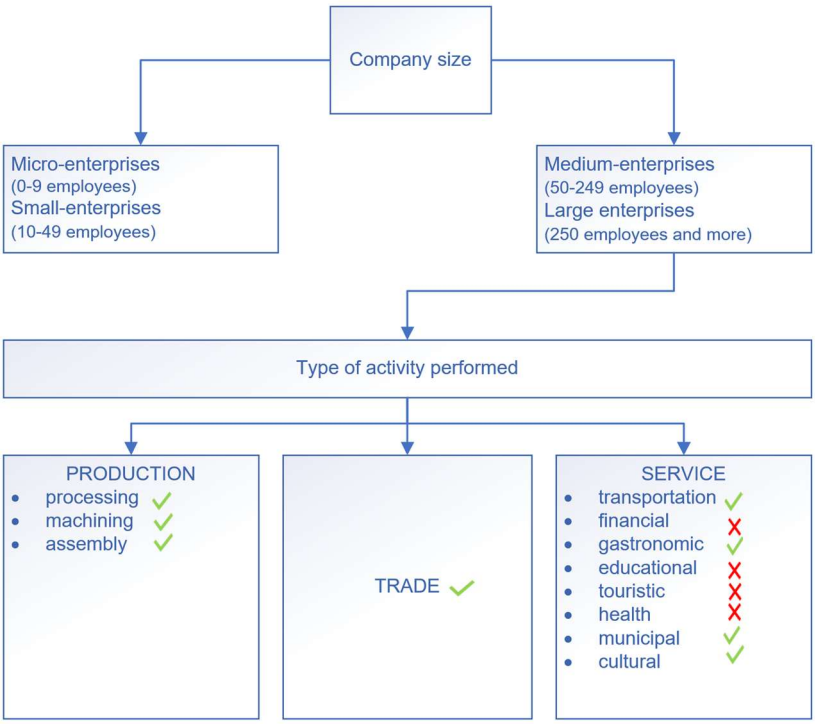


Fig. 5.1 Selection scheme of companies for the purpose of the transport survey [own study]

Table 5.1 List of companies selected to carry out a transport survey in Bydgoszcz

NO.	COMPANY NAME	ADDRESS	INDUSTRY	DESCRIPTION
1.	Lidl Distribution centre	Ernsta Petersona 6,	Trade	Distribution centre
2.	Castorama	Szajnochy 1	Trade	DIY store
3.	Castorama	Szubińska 5	Trade	DIY store
4.	Leroy Merlin	Rejewskiego 5	Trade	DIY store
5.	IKEA Bydgoszcz	Skandynawska 1	Trade	Furniture store
6.	Oponeo.pl S.A.	Podleśna 17	Trade	Tire and rim shop
7.	Makro Cash and Carry Polska S.A. Bydgoszcz	Jana Pawła II 123	Trade	Store / Wholesale
8.	Carrefour Polska	Decherty 6	Wholesale	Distribution centre
9.	Kaufland Bydgoszcz Distribution centre	Ernsta Petersona 4B	Wholesale	Distribution centre
10.	Aber Sp. z o.o. Oddział	Przemysłowa 8	Wholesale	Food distribution
11.	P.P.H.U. Edbol Sp. z o.o.	Przemysłowa 8	Wholesale	Food distribution
12.	Baustoff + Metall Color Sp. z o. o	Pułaskiego 47	Wholesale	Building materials warehouse
13.	Alan	Inwalidów 51	Wholesale	Furniture materials warehouse
14.	Holkap Sp. z o.o.	Bydgoskich Przemysłowców 3	Wholesale	Wholesale and warehouse services
15.	GENDERKA	Raczkowskiego 1	Wholesale	Building materials warehouse
16.	Mat-bud	Przemysłowa 27	Wholesale	Building materials warehouse
17.	BIMS PLUS BYDGOSZCZ	Hermana Frankego 1	Wholesale	Sanitary materials warehouse
18.	Drukarnia Franczak sp. z o.o.	Glinki 144	Manufacturer	Printing house
19.	Jowisz-Dodatki do Żywności Sp. z o.o.	Glinki 144	Manufacturer	Food distribution

20.	VOLEX Poland Sp. z o.o.	Fordońska 418	Manufacturer	Electrical appliances producer
21.	Boruta-Zachem SA	Wojska Polskiego 65	Manufacturer	Chemical producer
22.	Ciech Pianki Sp. z o.o.	Hutnicza 113	Manufacturer	Chemical producer
23.	Lifocolor Farbplast Sp. z o.o.	Raczkowskiego 2	Manufacturer	Chemical producer
24.	Pilkington IGP Sp. z o.o. Oddział w Bydgoszczy	Ołowiana 13	Manufacturer	Chemical producer
25.	Unilever Polska S.A.	Kraszewskiego 20	Manufacturer	Chemical producer
26.	TELDAT	Cicha 19	Manufacturer	Producer of the defense industry
27.	Wojskowe Zakłady Lotnicze Nr 2 S.A.	Szubińska 107	Manufacturer	Producer of the defense industry
28.	Zakłady Chemiczne NITRO-CHEM S.A.	Wulffa 18	Manufacturer	Producer of the defense industry
29.	Minda KTSN Plastic and Tooling Solutions	Glinki 144B	Manufacturer	Car parts manufacturer
30.	BELMA ACCESSORIES SYSTEMS	Łochowska 69	Manufacturer	Machine manufacturer
31.	Pojazdy Szynowe PESA Bydgoszcz S.A.	Zygmunta Augusta 11	Manufacturer	Machine manufacturer
32.	PROJPRZEM MAKRUM S.A.	Plac Kościeleckich 3	Manufacturer	Machine manufacturer
33.	SPX FLOW	Rolbieskiego 2	Manufacturer	Machine manufacturer
34.	Jmbp	Srebrna 12	Manufacturer	Producer of building materials
35.	Odlewnia żeliwa Bydgoszcz	Zygmunta augusta 11	Manufacturer	Producer of building materials
36.	Polbruk	Przemysława 30	Manufacturer	Producer of building materials

37.	Przedsiębiorstwo Produkcji Mas Betonowych Bosta-Beton Sp. z o.o.	Przemysława 30	Manufacturer	Producer of building materials
38.	Sklejka Multi S.A. Bydgoskie Zakłady Sklejek	Fordońska 154	Manufacturer	Producer of building materials
39.	Skraw-mech	Zygmunta augusta 11	Manufacturer	Producer of building materials
40.	Stabud-Przemysłówka Sp. z o.o.	Glinki 144	Manufacturer	Producer of building materials
41.	Btm meble	Rycerska 22	Manufacturer	Furniture manufacturer
42.	IMS Sofa	Bydgoska 50	Manufacturer	Furniture manufacturer
43.	Komandor Bydgoszcz S.A., Zakład Produkcyjny	Łowicka 50	Manufacturer	Furniture manufacturer
44.	S&K EURO MEBEL BYDGOSZCZ S.C.	Glinki 144	Manufacturer	Furniture manufacturer
45.	CIMAT	Raczkowskiego 4	Manufacturer	Tool manufacturer
46.	METALBARK Sp. z o.o. Sp. k	Petersona 11	Manufacturer	Tool manufacturer
47.	Pol-Trade Sp. z o.o.	Przemysłowa 8	Manufacturer	Flooring producer
48.	BKT Elektronik Sp. z o.o.	Łochowska 69	Manufacturer	Manufacturer of the electrical industry
49.	Famor S.A.	Kaszubska 25	Manufacturer	Manufacturer of the electrical industry
50.	Kolejowe Zakłady Łączności	Ludwikowo 1	Manufacturer	Manufacturer of the electrical industry
51.	PIXEL Sp. z o.o.	Raczkowskiego 5	Manufacturer	Manufacturer of the electrical industry
52.	POLON-ALFA S.A.	Glinki 155,	Manufacturer	Manufacturer of the electrical industry
53.	TE Connectivity Polska Sp. z o.o.	Unii Lubelskiej 4	Manufacturer	Manufacturer of the electrical industry

54.	Tele-Fonika Kable Bydgoszcz S.A.	Fordońska 152	Manufacturer	Manufacturer of the electrical industry
55.	Aplex	Podmiejska 4	Manufacturer	Manufacturer of plastics
56.	ARRK Shapers' Polska Sp. z o.o.	Rynkowa 9	Manufacturer	Manufacturer of plastics
57.	Can-pack	Kobaltowa 2	Manufacturer	Manufacturer of plastics
58.	HANPLAST	Paciorkiewicza 3	Manufacturer	Manufacturer of plastics
59.	keeeper sp. z o.o.	Mokra 3	Manufacturer	Manufacturer of plastics
60.	Plastpur Sp. z o.o.	Osiedle Rzemieślnicze 48	Manufacturer	Manufacturer of plastics
61.	Prettl Adion Polska. Sp. z o.o.	Glinki 146	Manufacturer	Manufacturer of plastics
62.	Stomil S.A. Bydgoskie Zakłady Przemysłu Gumowego	Toruńska 155	Manufacturer	Manufacturer of plastics
63.	Cgh polska	Srebrna 39	Manufacturer	Manufacturer of industrial equipment
64.	Metalkas S.A	Deszczowa 63	Manufacturer	Manufacturer of industrial equipment
65.	POL-Osteg Sp z o.o.	Filtrowa 25	Manufacturer	Manufacturer of industrial equipment
66.	Austenit Stal Handel Sp. z o.o.	Glinki 144	Manufacturer	Producer of steel products
67.	Drozapol-Profil S.A.	Toruńska 298A	Manufacturer	Producer of steel products
68.	Trans-stal	Niklowa 4	Manufacturer	Producer of steel products
69.	Abramczyk Sp. Z o.o.	Inflacka 7	Manufacturer	Food producer
70.	Ako S.A.	Startowa 2A	Manufacturer	Food producer
71.	Colian Jutrzenka (Production plant)	Srebrna 22	Manufacturer	Food producer
72.	Drobex	Przemysłowa 27	Manufacturer	Food producer

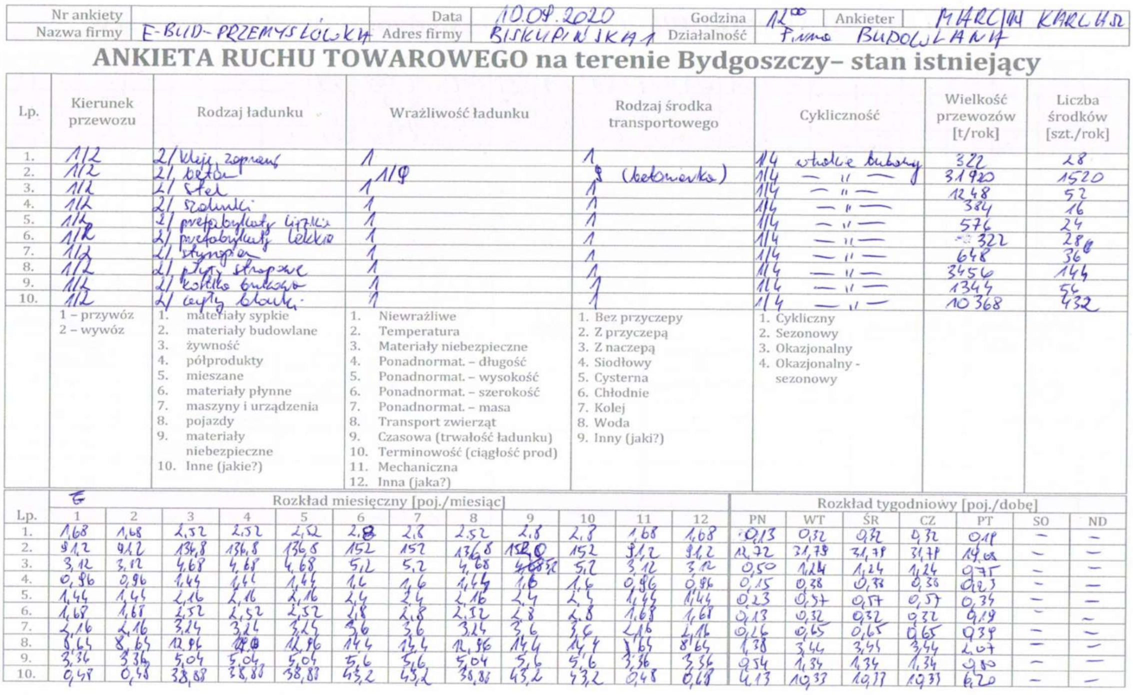
73.	Frosta Sp. Z o.o.	Witebska 63	Manufacturer	Food producer
74.	Globalmalt Polska. Sp. z o.o.	Fordońska 400	Manufacturer	Food producer
75.	Jago. Fabryka wyrobów cukierniczych.	Objazdowa 20	Manufacturer	Food producer
76.	Polmass S.A. Zakład preparatów paszowych	Grunwaldzka 287	Manufacturer	Food producer
77.	Spółdzielnia Mleczarska „MLEKPOL"	Niklowa 4	Manufacturer	Food producer
78.	STOVIT GROUP Sp. z o.o	Transportowa 4	Manufacturer	Food producer
79.	Erplast	Witebska 27	Manufacturer	Production and sale of road signs
80.	METGIS. Przedsiębiorstwo Produkcyjno - Usługowe	Fordońska 399	Manufacturer	Equipment production
81.	Lafarge	Dąbrowa 35	Manufacturer	Concrete plant
82.	CYNKOPOL Galwanotechnika Precyzyjna	Glinki 146	Services	Chemical producer
83.	Man lkw - serwis	Ludwikowo 2a	Services	Truck service
84.	Maktronik S.A,	Deszczowa 61	Services	Truck service
85.	Ivy Technology	Fordońska 248g	Services	Electrical appliances service
86.	Teleplan Polska Sp. z o.o.	Przemysłowa 8	Services	Electrical appliances service
87.	FedEx Express Polska	Przemysłowa 8	Courier service	Courier service
88.	DB Schenker Oddział Bydgoszcz	Fordońska 266	Logistics services	Logistics services

89.	GK TSL Transport Spedycja Logistyka Sp. z o.o Sp. k.	Grunwaldzka 4	Logistics services	Logistics services
90.	ID Logistics Polska S.A.	Dachtery 6	Logistics services	Logistics services
91.	ROHLIG SUUS Logistics S.A. Oddział Bydgoszcz	Petersona 4a	Logistics services	Logistics services
92.	UMSS Transport Spedycja Logistyka Magazynowanie	Kościuszki 27	Logistics services	Logistics services
93.	PKO Cargo	Inwalidów 10	Logistics services	Logistics services
94.	P.U.K. Corimp Sp. z o.o.	Wojska Polskiego 65	Waste management	Waste management
95.	E-Bud Przemysłówka	Biskupińska 1	Construction	Building construction
96.	Affabre PPU Sp. z .o.o.	Inwalidów 1	Construction	Linear construction
97.	BetPol S.A.	Inwalidów 49	Construction	Linear construction
98.	Volex POLAND Sp. z o.o.	Podłużna 11-13	Manufacturer	Telecommunications producer
99.	Abramczyk Sp z o.o.	Witebska	Manufacturer	Food processing
100.	BWJ Inwestycje	Smoleńska 53	Construction	Building construction
101.	Gotowski budownictwo Komunikacyjne i Przemysłowe	Glinki 144	Construction	Building and linear construction
102.	KabaBis	Wydmy 3	Construction	Linear construction

6 PRESENTATION OF TRANSPORT SURVEY RESULTS

Based on the diagram of the transport survey presented in chapter 3.2, prepared in order to determine the freight traffic in the city caused by the planned multimodal terminals, an attempt was made to obtain the data indicated in the survey. On the basis of the procedure described in chapter 5.2, enterprises were selected in which it would be advisable to conduct a survey. From January 2020, the procedure of obtaining data for the survey began by sending messages by e-mail along with the survey, and then an attempt was made to contact people dealing with logistics and deliveries in individual companies by phone. The response to the survey attempt turned out to be small. In the first stage, approximately 20% of companies initially expressed that it would be possible to conduct the indicated survey. However, when the limitations and restrictions related to the introduction of the COVID19 epidemic in the territory of the country were introduced, interviewing representatives of the selected companies turned out to be almost impossible. Ultimately, until the work on the report was completed, surveys were conducted in only 9% of the selected enterprises. The indicated size of the surveys carried out, from the statistical point of view, makes it impossible to reliably infer the volume of freight traffic in the current and forecast condition. The acquired sample is unrepresentative, so only to perform reliable statistical analyzes on its basis. Therefore, the analyzes additionally used the expert assumptions described in Chapter 4.

Figures 6.1 ÷ 6.3 show an example of a completed transport survey for the current condition and the forecast condition. On the basis of the surveys carried out, it is possible to indicate certain issues raised by the respondents. As regards the comments submitted by entrepreneurs, it should be noted that they believe that the construction of multimodal terminals is an opportunity for the development of our region and their enterprises. Some of them, in particular construction companies, indicated that it would be possible to transport (in particular by water) some of the products, such as precast reinforced concrete structures or loose materials - such as aggregates used for concrete or road foundations. These materials, as indicated in the survey, could be imported from other regions of Europe. For example, Scandinavia was mentioned as one of the directions of import and export of construction materials or elements of building structures. It was also noted that an important parameter when using multimodal terminals is the time and cost of transporting goods. It was emphasized that an increase in transport costs is possible, but only in the case of a significant shortening of the delivery time. On the other hand, in the case of the possibility of opening new sales markets by enabling the distribution of goods through multimodal terminals, the factor related to the delivery time becomes secondary.



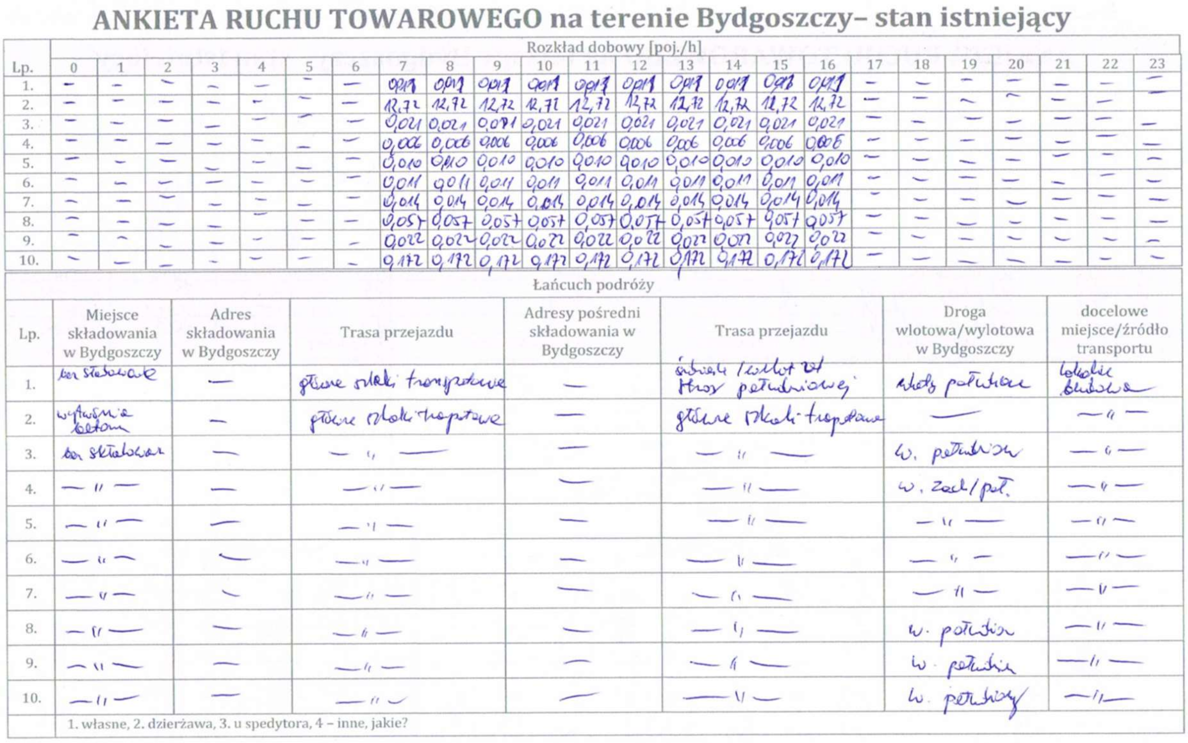
Nr ankiety		Data	10.08.2020	Godzina	12[00]	Ankieter	MARCIN KARLUS
Nazwa firmy	E-BUD-PRZEMYSŁÓWKA	Adres firmy	BISKUPIŃSKA 1	Działalność	Firma budowlana		

ANKIETA RUCHU TOWAROWEGO na terenie Bydgoszczy– stan istniejący

Lp.	Kierunek przewozu	Rodzaj ładunku	Wrażliwość ładunku	Rodzaj środka transportowego	Cykliczność	Wielkość przewozów [t/rok]	Liczba środków [szt./rok]
1.	1/2	2/ kleje, zaprawy	1	1	1/4 wszystkie budowy	322	28
2.	1/2	2/ beton	1/1/9	5 (betoniarka)	1/4 — " —	31920	1520
3.	1/2	2/ stal	1	1	1/4 — " —	1248	52
4.	1/2	2/ szalunki	1	1	1/4 — " —	384	16
5.	1/2	2/ prefabrykaty ciężkie	1	1	1/4 — " —	576	24
6.	1/2	2/ prefabrykaty lekkie	1	1	1/4 — " —	322	28
7.	1/2	2/ styropian	1	1	1/4 — " —	648	36
8.	1/2	2/ płyty stropowe	1	1	1/4 — " —	3456	144
9.	1/2	2/ kostka brukowa	1	1	1/4 — " —	1344	56
10.	1/2	2/ cegły, bloczki	1	1	1/4 — " —	10368	432
	1 – przywóz 2 – wywóz	1. materiały sypkie 2. materiały budowlane 3. żywność 4. półprodukty 5. mieszane 6. materiały płynne 7. maszyny i urządzenia 8. pojazdy 9. materiały niebezpieczne 10. Inne (jakie?)	1. Niewrażliwe 2. Temperatura 3. Materiały niebezpieczne 4. Ponadnormat. – długość 5. Ponadnormat. – wysokość 6. Ponadnormat. – szerokość 7. Ponadnormat. – masa 8. Transport zwierząt 9. Czasowa (trwałość ładunku) 10. Terminowość (ciągłość prod) 11. Mechaniczna 12. Inna (jaka?)	1. Bez przyczepy 2. Z przyczepą 3. Z naczepą 4. Siodłowy 5. Cysterna 6. Chłodnie 7. Kolej 8. Woda 9. Inny (jaki?)	1. Cykliczny 2. Sezonowy 3. Okazjonalny 4. Okazjonalny - sezonowy		

Lp.	Rozkład miesięczny [poj./miesiąc] 1	2	3	4	5	6	7	8	9	10	11	12	Rozkład tygodniowy [poj./dobę] PN	WT	ŚR	CZ	PT	SO	ND
1.	1,68	1,68	2,52	2,52	2,52	2,8	2,8	2,52	2,8	2,8	1,68	1,68	0,13	0,32	0,32	0,32	0,19	–	–
2.	91,2	91,2	136,8	136,8	136,8	152	152	136,8	152,0	152	91,2	91,2	12,72	31,78	31,78	31,78	19,08	–	–
3.	3,12	3,12	4,68	4,68	4,68	5,2	5,2	4,68	5,2	5,2	3,12	3,12	0,50	1,24	1,24	1,24	0,75	–	–
4.	0,96	0,96	1,44	1,44	1,44	1,6	1,6	1,44	1,6	1,6	0,96	0,96	0,15	0,38	0,38	0,38	0,23	–	–
5.	1,44	1,44	2,16	2,16	2,16	2,4	2,4	2,16	2,4	2,4	1,44	1,44	0,23	0,57	0,57	0,57	0,34	–	–
6.	1,68	1,68	2,52	2,52	2,52	2,8	2,8	2,52	2,8	2,8	1,68	1,68	0,13	0,32	0,32	0,32	0,19	–	–
7.	2,16	2,16	3,24	3,24	3,24	3,6	3,6	3,24	3,6	3,6	2,16	2,16	0,26	0,65	0,65	0,65	0,39	–	–
8.	8,64	8,64	12,96	[illegible]	12,96	14,4	14,4	12,96	14,4	14,4	8,64	8,64	1,38	3,44	3,44	3,44	2,07	–	–
9.	3,36	3,36	5,04	5,04	5,04	5,6	5,6	5,04	5,6	5,6	3,36	3,36	0,54	1,34	1,34	1,34	0,80	–	–
10.	0,48	0,48	38,88	38,88	38,88	43,2	43,2	38,88	43,2	43,2	0,48	0,68	4,13	10,33	10,33	10,33	6,20	–	–

Fig. 6.1. An example of a completed transport survey page 1 - Freight traffic survey in Bydgoszcz - the current state



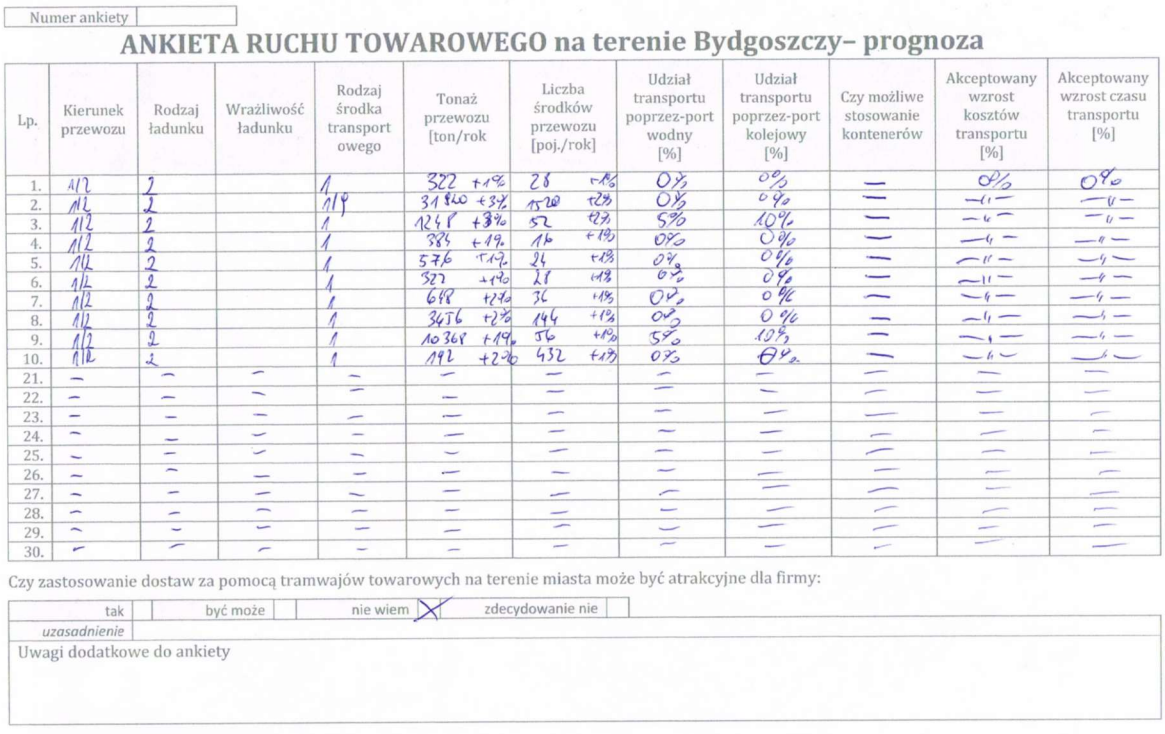
ANKIETA RUCHU TOWAROWEGO na terenie Bydgoszczy– stan istniejący

Lp.	Rozkład dobowy [poj./h] 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.	–	–	–	–	–	–	–	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	–	–	–	–	–	–	–
2.	–	–	–	–	–	–	–	12,72	12,72	12,72	12,72	12,72	12,72	12,72	12,72	12,72	12,72	–	–	–	–	–	–	–
3.	–	–	–	–	–	–	–	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	–	–	–	–	–	–	–
4.	–	–	–	–	–	–	–	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	–	–	–	–	–	–	–
5.	–	–	–	–	–	–	–	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	–	–	–	–	–	–	–
6.	–	–	–	–	–	–	–	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	–	–	–	–	–	–	–
7.	–	–	–	–	–	–	–	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	–	–	–	–	–	–	–
8.	–	–	–	–	–	–	–	0,057	0,057	0,057	0,057	0,057	0,057	0,057	0,057	0,057	0,057	–	–	–	–	–	–	–
9.	–	–	–	–	–	–	–	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	–	–	–	–	–	–	–
10.	–	–	–	–	–	–	–	0,172	0,172	0,172	0,172	0,172	0,172	0,172	0,172	0,172	0,172	–	–	–	–	–	–	–

Łańcuch podróży

Lp.	Miejsce składowania w Bydgoszczy	Adres składowania w Bydgoszczy	Trasa przejazdu	Adresy pośredni składowania w Bydgoszczy	Trasa przejazdu	Droga wlotowa/wylotowa w Bydgoszczy	docelowe miejsce/źródło transportu
1.	baza składowa	—	główne szlaki transportowe	—	[illegible] południowej	wloty południowe	lokalne budowy
2.	wytwórnia betonu	—	główne szlaki transportowe	—	główne szlaki transportowe	—	— " —
3.	baza składowa	—	— " —	—	— " —	w. południowy	— " —
4.	— " —	—	— " —	—	— " —	w. zach/pd.	— " —
5.	— " —	—	— " —	—	— " —	— " —	— " —
6.	— " —	—	— " —	—	— " —	— " —	— " —
7.	— " —	—	— " —	—	— " —	— " —	— " —
8.	— " —	—	— " —	—	— " —	w. południowy	— " —
9.	— " —	—	— " —	—	— " —	w. południowy	— " —
10.	— " —	—	— " —	—	— " —	w. południowy	— " —
	1. własne, 2. dzierżawa, 3. u spedytora, 4 – inne, jakie?						

Fig. 6.2. An example of a completed transport survey page 2 - Freight traffic survey in Bydgoszcz - the current state



Numer ankiety

ANKIETA RUCHU TOWAROWEGO na terenie Bydgoszczy– prognoza

Lp.	Kierunek przewozu	Rodzaj ładunku	Wrażliwość ładunku	Rodzaj środka transportowego	Tonaż przewozu [ton/rok	Liczba środków przewozu [poj./rok]	Udział transportu poprzez-port wodny [%]	Udział transportu poprzez-port kolejowy [%]	Czy możliwe stosowanie kontenerów	Akceptowany wzrost kosztów transportu [%]	Akceptowany wzrost czasu transportu [%]
1.	1/2	2		1	322 +1%	28 +1%	0%	0%	—	0%	0%
2.	1/2	2		1/9	31 840 +3%	1520 +2%	0%	0%	—	—	—
3.	1/2	2		1	1248 +3%	52 +2%	5%	10%	—	—	—
4.	1/2	2		1	384 +1%	16 +1%	0%	0%	—	—	—
5.	1/2	2		1	576 +1%	24 +2%	0%	0%	—	—	—
6.	1/2	2		1	327 +1%	28 +1%	0%	0%	—	—	—
7.	1/2	2		1	648 +2%	36 +1%	0%	0%	—	—	—
8.	1/2	2		1	3456 +2%	144 +1%	0%	0%	—	—	—
9.	1/2	2		1	10 368 +1%	56 +1%	5%	10%	—	—	—
10.	1/2	2		1	192 +2%	432 +1%	0%	0%	—	—	—
21.	—	—	—	—	—	—	—	—	—	—	—
22.	—	—	—	—	—	—	—	—	—	—	—
23.	—	—	—	—	—	—	—	—	—	—	—
24.	—	—	—	—	—	—	—	—	—	—	—
25.	—	—	—	—	—	—	—	—	—	—	—
26.	—	—	—	—	—	—	—	—	—	—	—
27.	—	—	—	—	—	—	—	—	—	—	—
28.	—	—	—	—	—	—	—	—	—	—	—
29.	—	—	—	—	—	—	—	—	—	—	—
30.	—	—	—	—	—	—	—	—	—	—	—

Czy zastosowanie dostaw za pomocą tramwajów towarowych na terenie miasta może być atrakcyjne dla firmy:

tak		być może		nie wiem	X	zdecydowanie nie	

uzasadnienie

Uwagi dodatkowe do ankiety

Fig. 6.3. An example of a completed transport survey page 3 - Freight traffic survey in Bydgoszcz - forecast

7 IMPACT OF MULTIMODAL TERMINALS ON ROAD TRAFFIC IN THE CITY OF BYDGOSZCZ

7.1 OBJECTIVE

The main objective of the analysis of the impact of multimodal terminals on road traffic in the city of Bydgoszcz is to determine the traffic volume on the city's transport network after the analyzed multimodal terminals are launched. The analysis assumes that the construction of new multimodal terminals will affect the change and supplementation of freight transport to and from the city by selected production plants and logistics companies. It is assumed that these plants and logistics companies will decide to transport products and semi-finished products directly from multimodal terminals, as well as to export their own production using these terminals. As a result of this activity, it is expected that the freight traffic will increase, which may potentially affect the functioning of transport in the city. In extreme cases, it can even lead to investment needs in order to meet new transport situation.

7.2 ANALYSIS PERIOD

The analysis of road traffic related to the construction of multimodal terminals was divided into the following periods:

- 2025 – the beginning of the so-called Emilianowo road and railway terminal,
- 2030,
- 2035,
- 2040 – the beginning of the functioning of the multimodal platform Bydgoszcz-Solec Kujawski
- 2045,
- 2050.

For the above-mentioned periods, prognostic transport models were developed for two variants:

- non-investment option - without building multimodal terminals;
- investment variant - with the construction of the Emilianowo railway terminal in 2025 and the Bydgoszcz - Solec Kujawski multimodal platform in 2040.

The forecasts adopted above are of a planning nature and make it possible to compare the obtained analysis results with other planning documents prepared for the city. In the document "Location study for the investment project entitled "Multimodal platform based on water, rail, road and air transport with a logistics hub and a river port located on the indicated area of the left bank of the Vistula (km 766-771), including the area of the city of Bydgoszcz and the commune of Solec Kujawski" the date of the initial launch of the multimodal platform was indicated, to a limited extent, as part of the first stage of its operation for 2028. In the analysis of the assumptions presented in the above document, and in the work schedule, this deadline was considered unrealistic. The basis for indicating a later date for the launch of the multimodal platform are the following reasons:

- the work schedule included in the ‘Study...’ sets the period from November 2018 to January 2020 for negotiations with potential partners in order to establish a special purpose vehicle for the terminal construction and January 2021 is set as the date of its establishment; at present,

negotiations are at an early stage causing understandable delays in the implementation of the project;
- delay in the implementation of the key document for navigation on the Vistula entitled: "Feasibility study for the comprehensive development of international waterways E-40 for the Vistula river on the section from Gdańsk to Warsaw, E-40 from Warsaw to the border Poland-Belarus (Brest) and E- 70 on the section from the Vistula to the Vistula Lagoon (Elbląg) "commissioned by the port in Gdańsk;
- protests of environmental organizations related to the planned construction of the barrage in Siarzewo;
- liquidation of the Ministry of Maritime Economy and Inland Navigation and transfer of competences in the field of inland navigation to the Ministry of Infrastructure;
- the COVID-19 epidemic and its negative impact on public finances and organizational issues, currently difficult to define in detail;

Taking into account the above factors, the date of launching the Bydgoszcz-Solec Kujawski multimodal platform, set out in the 'Study...', was considered unrealistic, while proposing, according to our estimates, the year 2040 to be realistic.

Moreover, considering the advancement of works on the construction of the road and rail terminal in Emilianowo and the problems arising directly from the current socio-economic situation related to the COVID-19 pandemic, we consider 2025 to be realistic for the launch of the above terminal.

7.3 DEMAND FOR TRANSPORT RELATED TO MULTIMODAL TERMINALS

On the basis of the conducted survey analysis (see chapter 6), as well as a detailed expert analysis, companies were selected for which the analyzed multimodal terminals may be places of sending and receiving goods, i.e. they may be sources and destinations. It is assumed that the currently operating enterprises will also function during the forecast period, and the emergence of multimodal terminals will contribute to their use of new forms of transport. It is assumed that these terminals, together with the warehouse part, will enable the supply of semi-finished products and products to these enterprises, necessary for their current operations. At the same time, these terminals will enable the distribution of products manufactured by these units. In addition, they will also contribute to the revival of forwarding and distribution activities. Hence, the selected companies were divided into three groups:

- Manufacturing companies - transporting semi-finished products necessary for ongoing operations from terminals, as well as manufactured finished products to terminals.
- Transport companies - transporting products between their distribution points and multimodal terminals.
- Distribution centres of commercial networks, transporting durable products between their distribution points and multimodal terminals.

Fig. 7.1 shows the location of forecasted traffic points in freight transport to and from multimodal terminals. It should be noted that a significant part of these points are located in the immediate vicinity of the planned multimodal terminals - i.e. in the area of the Industrial and Technological Park.

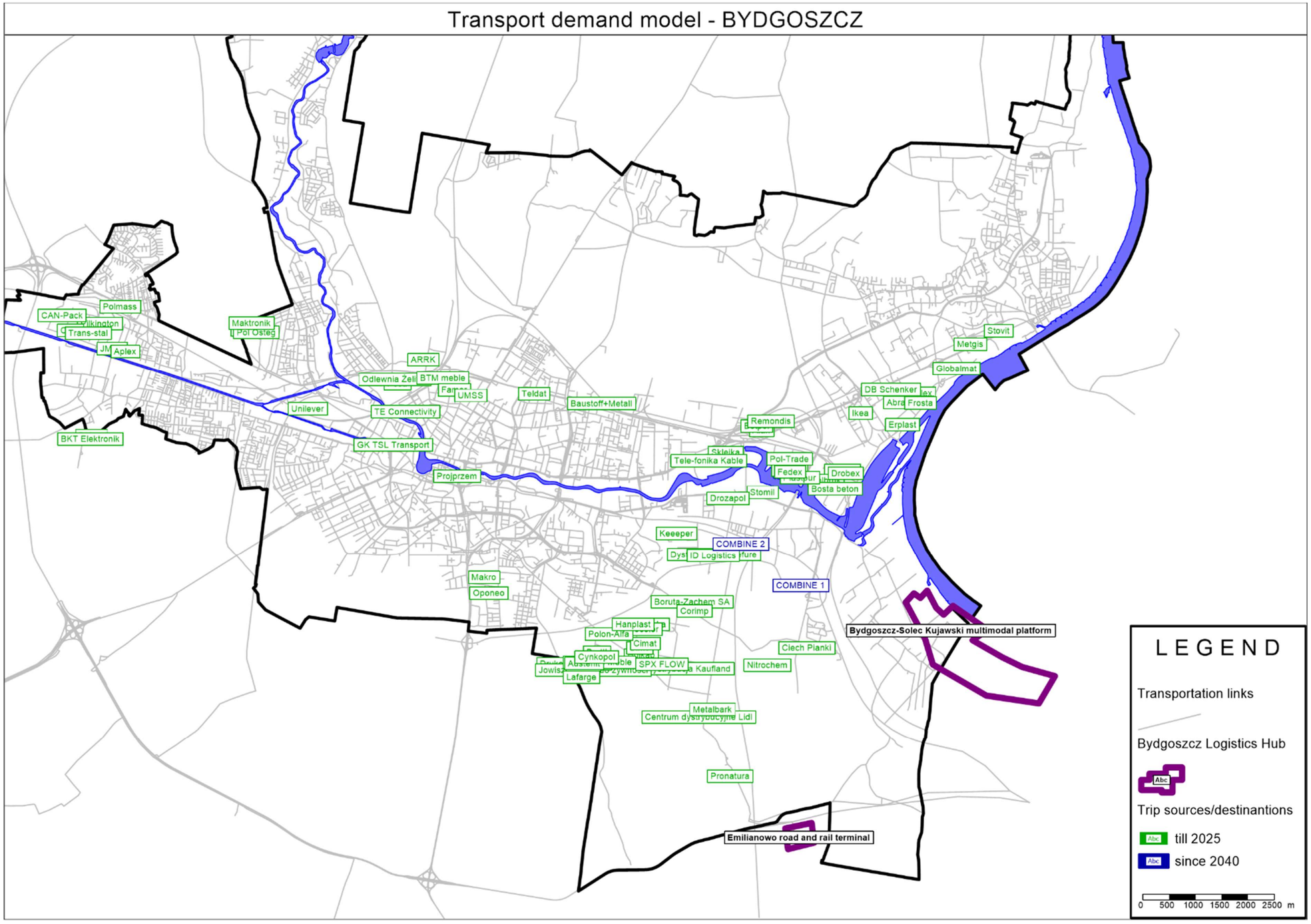


Fig. 7.1. Location of forecasted traffic points in freight transport from and to the facilities of the Bydgoszcz logistics hub in 2025-2050.

Undoubtedly, it is beneficial for the functioning of multimodal ports, companies and the city. This means relatively short freight transport without a large impact on the city's transport network.

On the basis of the survey analysis (see chapter 6), a review of the literature and a detailed expert analysis, the potential number of trips by trucks and vans in space of one year was determined. The following tables 7.1 - 7.6 present a summary of the forecasted annual journeys of van vehicles (up to 3.5 t) and average daily trucks between potential traffic generating points and multimodal terminals. In addition, it is predicted that the creation of the Multimodal Platform Bydgoszcz - Solec Kujawski will contribute to the economic activation of the areas in the Łęgnowo area marked as COMBINE 1 (around the existing Łęgnowo tram terminus) and COMBINE 2 (between Nowotoruńska and Chemiczna Streets). These areas are intended for business activities. It is assumed that both areas will become economically active in 2040 with the full functioning of the Bydgoszcz logistics hub, with the main profile of activity in these areas being logistics services.

Additionally, the journeys of van and truck vehicles from individual city inlets - traffic absorbed by the city - are forecast. The list of forecasted volume of these vehicles is presented in tables 7.7 (truck vehicles) and 7.8 (van vehicles up to 3.5 tons), respectively. All these vehicles can additionally burden the city's road network in the journeys between city inlets / outlets and multimodal terminals.

Table 7.1 List of forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the logistics hub in Bydgoszcz - forecast 2025 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	0	0	23
Ikea	0	0	0	117
Oponeo	0	0	336	23
Makro	0	0	0	58
Carrefure distribution	0	0	168	233
Kaufland distribution	0	0	168	233
Aber	0	0	0	233
Edbol	0	0	42	23
Baustoff/Metall	0	0	84	350
Alan	0	0	252	47

Betpol	0	0	42	233
Holkap	0	0	0	23
Genderka	0	0	42	117
Matbud	0	0	0	58
Bims	0	0	84	117
Drukarnia Franczak	0	0	126	47
Jowisz- food additives	0	0	42	47
Volex	0	0	168	117
Boruta Zachem	0	0	0	466
Ciech Pianki	0	0	84	23
Nitrochem	0	0	42	58
Lifocolor	0	0	168	233
Pilkington	0	0	210	23
Unilever	0	0	0	47
Teldat	0	0	0	350
Minda	0	0	0	47
Belma	0	0	0	350
Pesa	0	0	0	47
Projprzem	0	0	0	47
SPX FLOW	0	0	0	117
JMBP	0	0	0	117
Odlewnia Żeliwa	0	0	0	23
Polbruk	0	0	0	23
Bosta beton	0	0	0	233
Sklejka	0	0	0	699
Stabud	0	0	0	233

BTM meble	0	0	42	23
S&K Euro Meble	0	0	0	233
Cimat	0	0	0	47
Metalbark	0	0	0	117
Pol-Trade	0	0	84	175
BKT Elektronik	0	0	0	47
Famor	0	0	168	233
Polon-Alfa	0	0	126	23
TE Connectivity	0	0	0	47
Tele-fonika Kable	0	0	0	350
Aplex	0	0	0	233
ARRK	0	0	0	47
CAN-Pack	0	0	0	47
Hanplast	0	0	0	233
Keeeper	0	0	0	117
Plastpur	0	0	126	23
Prettl	0	0	84	233
Stomil	0	0	126	117
CGH	0	0	0	117
Metalkas	0	0	168	47
Pol Osteg	0	0	0	233
Austenit	0	0	0	350
Drozapol	0	0	0	58
Trans-stal	0	0	0	233
Abramczyk	0	0	210	466
Drobex	0	0	0	23

Frosta	0	0	0	23
Globalmat	0	0	0	23
Polmass	0	0	0	47
Stovit	0	0	0	23
Erplast	0	0	84	23
Metgis	0	0	0	23
Lafarge	0	0	0	175
Cynkopol	0	0	0	70
Maktronik	0	0	84	466
Fedex	0	0	420	233
DB Schenker	0	0	0	1.165
GK TSL Transport	0	0	0	233
ID Logistics	0	0	84	932
UMSS	0	0	336	699
Corimp	0	0	0	466
Pronatura	0	0	0	233
Remondis	0	0	0	466
Sum of the vehicles	**0**	**0**	**4.200**	**14.400**
Total tonnage	**-**	**-**	**5.250**	**360.000**

Table 7.2 List of the forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the logistics hub in Bydgoszcz - forecast 2030 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	0	0	29
Ikea	0	0	0	146
Oponeo	0	0	504	29
Makro	0	0	0	73
Carrefure distribution	0	0	252	291
Kaufland distribution	0	0	252	291
Aber	0	0	0	291
Edbol	0	0	63	29
Baustoff/Metall	0	0	126	437
Alan	0	0	378	58
Betpol	0	0	63	291
Holkap	0	0	0	29
Genderka	0	0	63	146
Matbud	0	0	0	73
Bims	0	0	126	146
Drukarnia Franczak	0	0	189	58
Jowisz- food additives	0	0	63	58
Volex	0	0	252	146
Boruta Zachem	0	0	0	583
Ciech Pianki	0	0	126	29
Nitrochem	0	0	63	73
Lifocolor	0	0	252	291

Pilkington	0	0	315	29
Unilever	0	0	0	58
Teldat	0	0	0	437
Minda	0	0	0	58
Belma	0	0	0	437
Pesa	0	0	0	58
Projprzem	0	0	0	58
SPX FLOW	0	0	0	146
JMBP	0	0	0	146
Odlewnia Żeliwa	0	0	0	29
Polbruk	0	0	0	29
Bosta beton	0	0	0	291
Sklejka	0	0	0	874
Stabud	0	0	0	291
BTM meble	0	0	63	29
S&K Euro Meble	0	0	0	291
Cimat	0	0	0	58
Metalbark	0	0	0	146
Pol-Trade	0	0	126	218
BKT Elektronik	0	0	0	58
Famor	0	0	252	291
Polon-Alfa	0	0	189	29
TE Connectivity	0	0	0	58
Tele-fonika Kable	0	0	0	437
Aplex	0	0	0	291
ARRK	0	0	0	58

CAN-Pack	0	0	0	58
Hanplast	0	0	0	291
Keeeper	0	0	0	146
Plastpur	0	0	189	29
Prettl	0	0	126	291
Stomil	0	0	189	146
CGH	0	0	0	146
Metalkas	0	0	252	58
Pol Osteg	0	0	0	291
Austenit	0	0	0	437
Drozapol	0	0	0	73
Trans-stal	0	0	0	291
Abramczyk	0	0	315	583
Drobex	0	0	0	29
Frosta	0	0	0	29
Globalmat	0	0	0	29
Polmass	0	0	0	58
Stovit	0	0	0	29
Erplast	0	0	126	29
Metgis	0	0	0	29
Lafarge	0	0	0	218
Cynkopol	0	0	0	87
Maktronik	0	0	126	583
Fedex	0	0	630	291
DB Schenker	0	0	0	1.456
GK TSL Transport	0	0	0	291

ID Logistics	0	0	126	1.165
UMSS	0	0	504	874
Corimp	0	0	0	583
Pronatura	0	0	0	291
Remondis	0	0	0	583
Sum of the vehicles	**0**	**0**	**6.300**	**18.000**
Total tonnage	**-**	**-**	**7.875**	**450.000**

Table 7.3 List of the forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the logistics hub in Bydgoszcz - forecast 2035 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	0	0	36
Ikea	0	0	0	182
Oponeo	0	0	648	36
Makro	0	0	0	91
Carrefure distribution	0	0	324	364
Kaufland distribution	0	0	324	364
Aber	0	0	0	364
Edbol	0	0	81	36
Baustoff/Metall	0	0	162	546
Alan	0	0	486	73
Betpol	0	0	81	364
Holkap	0	0	0	36
Genderka	0	0	81	182
Matbud	0	0	0	91
Bims	0	0	162	182
Drukarnia Franczak	0	0	243	73
Jowisz- food additives	0	0	81	73
Volex	0	0	324	182
Boruta Zachem	0	0	0	728
Ciech Pianki	0	0	162	36
Nitrochem	0	0	81	91
Lifocolor	0	0	324	364

Pilkington	0	0	405	36
Unilever	0	0	0	73
Teldat	0	0	0	546
Minda	0	0	0	73
Belma	0	0	0	546
Pesa	0	0	0	73
Projprzem	0	0	0	73
SPX FLOW	0	0	0	182
JMBP	0	0	0	182
Odlewnia Żeliwa	0	0	0	36
Polbruk	0	0	0	36
Bosta beton	0	0	0	364
Sklejka	0	0	0	1.092
Stabud	0	0	0	364
BTM meble	0	0	81	36
S&K Euro Meble	0	0	0	364
Cimat	0	0	0	73
Metalbark	0	0	0	182
Pol-Trade	0	0	162	273
BKT Elektronik	0	0	0	73
Famor	0	0	324	364
Polon-Alfa	0	0	243	36
TE Connectivity	0	0	0	73
Tele-fonika Kable	0	0	0	546
Aplex	0	0	0	364
ARRK	0	0	0	73

CAN-Pack	0	0	0	73
Hanplast	0	0	0	364
Keeeper	0	0	0	182
Plastpur	0	0	243	36
Prettl	0	0	162	364
Stomil	0	0	243	182
CGH	0	0	0	182
Metalkas	0	0	324	73
Pol Osteg	0	0	0	364
Austenit	0	0	0	546
Drozapol	0	0	0	91
Trans-stal	0	0	0	364
Abramczyk	0	0	405	728
Drobex	0	0	0	36
Frosta	0	0	0	36
Globalmat	0	0	0	36
Polmass	0	0	0	73
Stovit	0	0	0	36
Erplast	0	0	162	36
Metgis	0	0	0	36
Lafarge	0	0	0	273
Cynkopol	0	0	0	109
Maktronik	0	0	162	728
Fedex	0	0	810	364
DB Schenker	0	0	0	1.820
GK TSL Transport	0	0	0	364

ID Logistics	0	0	162	1.456
UMSS	0	0	648	1.092
Corimp	0	0	0	728
Pronatura	0	0	0	364
Remondis	0	0	0	728
Sum of the vehicles	**0**	**0**	**8.100**	**22.500**
Total tonnage	**-**	**-**	**10.125**	**562.500**

Table 7.4 Summary of the forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the logistics hub in Bydgoszcz - forecast 2040 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	8	0	26
Ikea	0	38	0	128
Oponeo	122	8	488	26
Makro	0	19	0	64
Carrefure distribution	61	75	244	256
Kaufland distribution	61	75	244	256
Aber	0	75	0	256
Edbol	15	8	61	26
Baustoff/Metall	31	113	122	383
Alan	92	15	366	51
Betpol	15	75	61	256
Holkap	0	8	0	26
Genderka	15	38	61	128
Matbud	0	19	0	64
Bims	31	38	122	128
Drukarnia Franczak	46	15	183	51
Jowisz- food additives	15	15	61	51
Volex	61	38	244	128
Boruta Zachem	0	150	0	511
Ciech Pianki	31	8	122	26
Nitrochem	15	19	61	64
Lifocolor	61	75	244	256

Pilkington	76	8	305	26
Unilever	0	15	0	51
Teldat	0	113	0	383
Minda	0	15	0	51
Belma	0	113	0	383
Pesa	0	15	0	51
Projprzem	0	15	0	51
SPX FLOW	0	38	0	128
JMBP	0	38	0	128
Odlewnia Żeliwa	0	8	0	26
Polbruk	0	8	0	26
Bosta beton	0	75	0	256
Sklejka	0	226	0	767
Stabud	0	75	0	256
BTM meble	15	8	61	26
S&K Euro Meble	0	75	0	256
Cimat	0	15	0	51
Metalbark	0	38	0	128
Pol-Trade	31	56	122	192
BKT Elektronik	0	15	0	51
Famor	61	75	244	256
Polon-Alfa	46	8	183	26
TE Connectivity	0	15	0	51
Tele-fonika Kable	0	113	0	383
Aplex	0	75	0	256
ARRK	0	15	0	51

CAN-Pack	0	15	0	51
Hanplast	0	75	0	256
Keeeper	0	38	0	128
Plastpur	46	8	183	26
Prettl	31	75	122	256
Stomil	46	38	183	128
CGH	0	38	0	128
Metalkas	61	15	244	51
Pol Osteg	0	75	0	256
Austenit	0	113	0	383
Drozapol	0	19	0	64
Trans-stal	0	75	0	256
Abramczyk	76	150	305	511
Drobex	0	8	0	26
Frosta	0	8	0	26
Globalmat	0	8	0	26
Polmass	0	15	0	51
Stovit	0	8	0	26
Erplast	31	8	122	26
Metgis	0	8	0	26
Lafarge	0	56	0	192
Cynkopol	0	23	0	77
Maktronik	31	150	122	511
Fedex	153	75	610	256
DB Schenker	0	376	0	1.278
GK TSL Transport	0	75	0	256

ID Logistics	31	301	122	1.023
UMSS	122	226	488	767
Corimp	0	150	0	511
Pronatura	0	75	0	256
Remondis	0	150	0	511
COMBINE 1	92	752	366	2.556
COMBINE 2	183	602	732	2.045
Sum of the vehicles	**1.525**	**4.647**	**6.102**	**15.798**
Total tonnage	**1.907**	**116.165**	**7.627**	**394.962**

Table 7.5 List of the forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the Bydgoszcz logistic hub - forecast 2045 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	11	0	29
Ikea	0	56	0	143
Oponeo	244	11	549	29
Makro	0	28	0	71
Carrefure distribution	122	113	275	286
Kaufland distribution	122	113	275	286
Aber	0	113	0	286
Edbol	31	11	69	29
Baustoff/Metall	61	169	137	429
Alan	183	23	412	57
Betpol	31	113	69	286
Holkap	0	11	0	29
Genderka	31	56	69	143
Matbud	0	28	0	71
Bims	61	56	137	143
Drukarnia Franczak	92	23	206	57
Jowisz- food additives	31	23	69	57
Volex	122	56	275	143
Boruta Zachem	0	226	0	571
Ciech Pianki	61	11	137	29
Nitrochem	31	28	69	71
Lifocolor	122	113	275	286

Pilkington	153	11	343	29
Unilever	0	23	0	57
Teldat	0	169	0	429
Minda	0	23	0	57
Belma	0	169	0	429
Pesa	0	23	0	57
Projprzem	0	23	0	57
SPX FLOW	0	56	0	143
JMBP	0	56	0	143
Odlewnia Żeliwa	0	11	0	29
Polbruk	0	11	0	29
Bosta beton	0	113	0	286
Sklejka	0	338	0	857
Stabud	0	113	0	286
BTM meble	31	11	69	29
S&K Euro Meble	0	113	0	286
Cimat	0	23	0	57
Metalbark	0	56	0	143
Pol-Trade	61	85	137	214
BKT Elektronik	0	23	0	57
Famor	122	113	275	286
Polon-Alfa	92	11	206	29
TE Connectivity	0	23	0	57
Tele-fonika Kable	0	169	0	429
Aplex	0	113	0	286
ARRK	0	23	0	57

CAN-Pack	0	23	0	57
Hanplast	0	113	0	286
Keeeper	0	56	0	143
Plastpur	92	11	206	29
Prettl	61	113	137	286
Stomil	92	56	206	143
CGH	0	56	0	143
Metalkas	122	23	275	57
Pol Osteg	0	113	0	286
Austenit	0	169	0	429
Drozapol	0	28	0	71
Trans-stal	0	113	0	286
Abramczyk	153	226	343	571
Drobex	0	11	0	29
Frosta	0	11	0	29
Globalmat	0	11	0	29
Polmass	0	23	0	57
Stovit	0	11	0	29
Erplast	61	11	137	29
Metgis	0	11	0	29
Lafarge	0	85	0	214
Cynkopol	0	34	0	86
Maktronik	61	226	137	571
Fedex	305	113	686	286
DB Schenker	0	564	0	1.429
GK TSL Transport	0	113	0	286

ID Logistics	61	451	137	1.143
UMSS	244	338	549	857
Corimp	0	226	0	571
Pronatura	0	113	0	286
Remondis	0	226	0	571
COMBINE 1	183	1.128	412	2.857
COMBINE 2	366	902	824	2.286
Sum of the vehicles	**3.051**	**6.970**	**6.864**	**17.657**
Total tonnage	**3.814**	**174.248**	**8.581**	**441.429**

Table 7.6 List of forecasted annual journeys of vans (up to 3.5 t) and trucks between potential traffic points and the facilities of the logistics hub in Bydgoszcz - forecast 2050 (source: own study)

NAME OF THE TRAFFIC-GENERATING POINT	BYDGOSZCZ-SOLEC KUJAWSKI MULTIMODAL PLATFORM		EMILIANOWO ROAD AND RAILWAY TERMINAL	
	VANS	TRUCKS	VANS	TRUCKS
Lidl distribution centre	0	14	0	30
Ikea	0	70	0	152
Oponeo	305	14	631	30
Makro	0	35	0	76
Carrefure distribution	153	139	315	305
Kaufland distribution	153	139	315	305
Aber	0	139	0	305
Edbol	38	14	79	30
Baustoff/Metall	76	209	158	457
Alan	229	28	473	61
Betpol	38	139	79	305
Holkap	0	14	0	30
Genderka	38	70	79	152
Matbud	0	35	0	76
Bims	76	70	158	152
Drukarnia Franczak	114	28	236	61
Jowisz- food additives	38	28	79	61
Volex	153	70	315	152
Boruta Zachem	0	278	0	609
Ciech Pianki	76	14	158	30
Nitrochem	38	35	79	76
Lifocolor	153	139	315	305

Pilkington	191	14	394	30
Unilever	0	28	0	61
Teldat	0	209	0	457
Minda	0	28	0	61
Belma	0	209	0	457
Pesa	0	28	0	61
Projprzem	0	28	0	61
SPX FLOW	0	70	0	152
JMBP	0	70	0	152
Odlewnia Żeliwa	0	14	0	30
Polbruk	0	14	0	30
Bosta beton	0	139	0	305
Sklejka	0	417	0	914
Stabud	0	139	0	305
BTM meble	38	14	79	30
S&K Euro Meble	0	139	0	305
Cimat	0	28	0	61
Metalbark	0	70	0	152
Pol-Trade	76	104	158	228
BKT Elektronik	0	28	0	61
Famor	153	139	315	305
Polon-Alfa	114	14	236	30
TE Connectivity	0	28	0	61
Tele-fonika Kable	0	209	0	457
Aplex	0	139	0	305
ARRK	0	28	0	61

CAN-Pack	0	28	0	61
Hanplast	0	139	0	305
Keeeper	0	70	0	152
Plastpur	114	14	236	30
Prettl	76	139	158	305
Stomil	114	70	236	152
CGH	0	70	0	152
Metalkas	153	28	315	61
Pol Osteg	0	139	0	305
Austenit	0	209	0	457
Drozapol	0	35	0	76
Trans-stal	0	139	0	305
Abramczyk	191	278	394	609
Drobex	0	14	0	30
Frosta	0	14	0	30
Globalmat	0	14	0	30
Polmass	0	28	0	61
Stovit	0	14	0	30
Erplast	76	14	158	30
Metgis	0	14	0	30
Lafarge	0	104	0	228
Cynkopol	0	42	0	91
Maktronik	76	278	158	609
Fedex	381	139	788	305
DB Schenker	0	695	0	1.523
GK TSL Transport	0	139	0	305

ID Logistics	76	556	158	1.218
UMSS	305	417	631	914
Corimp	0	278	0	609
Pronatura	0	139	0	305
Remondis	0	278	0	609
COMBINE 1	229	1.391	473	3.045
COMBINE 2	458	1.113	946	2.436
Sum of the vehicles	**4.500**	**11.100**	**9.300**	**24.300**
Total tonnage	**5.625**	**277.500**	**11.625**	**607.500**

Table 7.7 Summary of forecasted annual journeys of trucks between inlets to Bydgoszcz and multimodal terminals - forecast 2025-2050 (source: own study)

FORECAST YEAR	2025		2030		2035		2040		2045		2050	
INLET	**PLATFORM**	**TERMINAL**	**PLATFORM**	**TERMINAL**	**PLATFORM**	**TERMINAL**	**PLATFORM**	**TERMINAL**	**PLATFORM**	**TERMINAL**	**PLATFORM**	**TERMINAL**
Koronowo	0	2.570	0	4.770	0	5.569	4.648	6.640	4.823	6.890	4.998	7.140
Niemcz	0	305	0	566	0	661	551	788	572	817	593	847
Osielsko/Gdańsk	0	6.106	0	11.331	0	13.231	11.043	15.775	11.458	16.369	11.874	16.962
Świecie	0	243	0	451	0	527	440	628	456	652	473	676
Zławieś Wielka	0	2.556	0	4.743	0	5.538	4.622	6.603	4.796	6.851	4.970	7.100
Solec Kujawski	0	160	0	296	0	346	289	413	300	428	311	444
Torun	0	1.329	0	2.466	0	2.879	2.403	3.433	2.493	3.562	2.584	3.691
Nowa Wieś Wielka	0	5.025	0	9.323	0	10.887	9.086	12.980	9.428	13.469	9.770	13.957
Białe Błota	0	5.057	0	9.384	0	10.957	9.145	13.065	9.489	13.556	9.834	14.048
Nakło	0	541	0	1.004	0	1.172	978	1.397	1.015	1.450	1.052	1.503
Szczecin/Nakło commune	0	2.436	0	4.520	0	5.278	4.405	6.293	4.571	6.530	4.737	6.767
Sicienko	0	672	0	1.246	0	1.455	1.215	1.735	1.260	1.800	1.306	1.866
Sum of the vehicles (one side)	**0**	**27.000**	**0**	**50.100**	**0**	**58.500**	**48.825**	**69.750**	**50.663**	**72.375**	**52.500**	**75.000**
Total tonnage [t]	**0**	**675.000**	**0**	**1.252.500**	**0**	**1.462.500**	**1.220.625**	**1.743.750**	**1.266.563**	**1.809.375**	**1.312.500**	**1.875.000**

Table 7.8 List of forecasted annual journeys of vans (up to 3.5 t) between inlets to Bydgoszcz and multimodal terminals - forecast 2025-2050 (source: own study)

FORECAST YEAR	2025		2030		2035		2040		2045		2050	
INLET	PLATFORM	TERMINAL	PLATFORM	TERMINAL	PLATFORM	TERMINAL	PLATFORM	TERMINAL	PLATFORM	TERMINAL	PLATFORM	TERMINAL
Koronowo	0	286	0	828	0	1.000	818	1.168	846	1.209	875	1.249
Niemcz	0	34	0	98	0	119	97	139	100	143	104	148
Osielsko/Gdańsk	0	678	0	1.968	0	2.375	1.943	2.775	2.010	2.872	2.078	2.968
pŚwiecie	0	27	0	78	0	95	77	111	80	114	83	118
Zławieś Wielka	0	284	0	824	0	994	813	1.162	841	1.202	870	1.242
Solec Kujawski	0	18	0	51	0	62	51	73	53	75	54	78
Torun	0	148	0	428	0	517	423	604	437	625	452	646
Nowa Wieś Wielka	0	558	0	1.619	0	1.954	1.599	2.284	1.654	2.363	1.710	2.443
Białe Błota	0	562	0	1.630	0	1.967	1.609	2.299	1.665	2.379	1.721	2.458
Nakło	0	60	0	174	0	210	172	246	178	254	184	263
Szczecin/Nakło commune	0	271	0	785	0	947	775	1.107	802	1.146	829	1.184
Sicienko	0	75	0	216	0	261	214	305	221	316	229	326
Sum of the vehicles (one side)	**0**	**3.000**	**0**	**8.700**	**0**	**10.500**	**8.590**	**12.272**	**8.889**	**12.698**	**9.188**	**13.125**
Total tonnage [t]	**0**	**3.750**	**0**	**10.875**	**0**	**13.125**	**10.738**	**15.340**	**11.111**	**15.873**	**11.484**	**16.406**

7.4 RESULTS OF MODEL TRAFFIC ANALYZES

Based on the assumptions presented in the previous chapters, the projected traffic volumes on the city road network and the city bypass were calculated for the forecasting periods 2025-2050. The results of the calculations are presented in the form of maps presenting respectively:

- traffic volumes related to multimodal terminals (passenger car, van and truck traffic);
- volumes of truck traffic related to multimodal terminals;
- van traffic volumes related to multimodal terminals.

Figures 7.2-7.19 show the daily traffic volume for each year of the forecast. On the other hand, tables 7.9 and 7.10 summarize the traffic parameters concerning transport performance and time spent on traveling on the city's transport network for two network states: W0 - without building terminals, W1 with functioning multimodal terminals. The tables use the following meanings:

Development variant – description of the analyzed scenario,
Year – year of analysis for a given scenario,
Length – length of the transport networks covered by the analysis,
(veh-km) passenger – transport work performed with passenger vehicles,
(veh-h) passenger – temporary transport work performed with passenger vehicles,
(veh-km) van – transport work performed with van vehicles,
(veh-h) van – temporary transport work performed with van vehicles,
(veh-km) truck – transport work performed by truck vehicles,
(veh-h) truck – temporary transport work performed by truck vehicles,
total passenger cars – the sum of journeys made by passenger vehicles,
total vans – the sum of journeys made by van vehicles,
sum of trucks – sum of journeys made by truck vehicles,
total average time passenger cars – average travel time by a passenger vehicle,
total average time vans – average travel time by a van,
total average trucks – average travel time by a truck vehicle,
average V passenger cars – the average travel speed by a passenger vehicle,
average V vans – the average travel speed by a van vehicle,
average V trucks – the average travel speed by a truck vehicle,
passengers – sum of passengers in passenger cars,
pass-km – the total kilometres travelled by passengers in passenger cars,
pass-hr – total hours spent by passengers in passenger cars,
ADT (Number of vehicles / day) – the average daily traffic volume on the city's road network.

Table 7.9 Summary of daily traffic parameters broken down into passenger vehicles, vans and trucks for two variants of the city development W0 - without the Bydgoszcz logistics hub, W1 - with an operating Bydgoszcz logistics hub - forecast 2025-2050 (source: own study)

scenario	forecast year	network length	veh-km private cars	veh-hours private cars	veh-km vans	veh-hours vans	veh-km trucks	veh-hours trucks	matrix sum private cars	matrix sum vans	matrix sum trucks	t_{avg} private cars	t_{avg} vans	t_{avg} trucks	V_{avg} private cars	V_{avg} vans	V_{avg} trucks
istniejący	2020	1,320.120	3,965,261	77,838	396,648	8,137	472,045	9,845	421,540	39,630	40,872	11.1	12.3	14.5	50.9	48.7	47.9
W0	2025	1,344.721	4,075,981	80,613	383,872	7,851	457,996	9,700	431,941	37,767	39,197	11.2	12.5	14.8	50.6	48.9	47.2
	2030	1,365.540	4,370,470	82,338	378,894	7,538	471,584	9,576	455,226	37,418	39,680	10.9	12.1	14.5	53.1	50.3	49.2
	2035	1,369.177	4,583,254	86,625	379,364	7,545	489,093	9,921	470,770	37,236	40,452	11.0	12.2	14.7	52.9	50.3	49.3
	2040	1,374.909	4,667,762	87,181	377,442	7,361	500,758	9,918	480,041	37,206	41,413	10.9	11.9	14.4	53.5	51.3	50.5
	2045	1,389.025	4,686,856	86,284	367,502	7,085	497,178	9,721	471,773	35,777	40,417	11.0	11.9	14.4	54.3	51.9	51.1
	2050	1,389.963	4,622,906	85,097	370,051	7,116	509,776	9,934	461,095	35,899	40,955	11.1	11.9	14.6	54.3	52.0	51.3
W1	2025	1,345.183	4,077,497	80,660	384,729	7,865	462,843	9,787	432,000	37,815	39,473	11.2	12.5	14.9	50.6	48.9	47.3
	2030	1,365.799	4,370,257	82,394	380,665	7,565	480,093	9,707	455,287	37,518	40,134	10.9	12.1	14.5	53.0	50.3	49.5
	2035	1,369.435	4,583,690	86,678	381,461	7,576	499,152	10,074	470,834	37,360	40,992	11.0	12.2	14.7	52.9	50.4	49.5
	2040	1,379.574	4,667,373	87,208	381,135	7,418	518,824	10,205	480,178	37,405	42,380	10.9	11.9	14.4	53.5	51.4	50.8
	2045	1,393.690	4,684,219	86,296	371,399	7,148	515,494	10,035	471,909	35,999	41,449	11.0	11.9	14.5	54.3	52.0	51.4
	2050	1,394.628	4,620,659	85,115	373,796	7,183	528,500	10,259	461,238	36,140	42,041	11.1	11.9	14.6	54.3	52.0	51.5

Table 7.10 Summary of daily traffic parameters for two variants of the city's development W0 - without the Bydgoszcz logistics hub, W1 - with an operating Bydgoszcz logistics hub - forecast 2025-2050 (source: own study)

scenario	forecast year	veh-km	veh-hours	passenegrs	pass-km	pass-hours	ADTT [veh/day]
nowadays	2020	4,833,954	85,977	628,504	6,023,532	119,172	6,019
W0	2025	4,917,848	88,464	638,488	6,140,643	122,347	6,012
	2030	5,220,949	89,876	668,892	6,532,089	124,153	6,285
	2035	5,451,712	94,170	689,689	6,826,688	130,078	6,545
	2040	5,545,961	94,543	702,673	6,946,290	130,614	6,631
	2045	5,551,536	93,369	689,498	6,957,593	128,974	6,570
	2050	5,502,732	92,214	676,278	6,889,604	127,676	6,508
W1	2025	4,925,070	88,527	638,888	6,148,319	122,511	6,019
	2030	5,231,015	89,960	669,524	6,542,092	124,384	6,296
	2035	5,464,303	94,255	690,436	6,839,410	130,331	6,559
	2040	5,567,332	94,627	704,016	6,967,544	130,993	6,634
	2045	5,571,112	93,445	690,929	6,976,378	129,368	6,571
	2050	5,522,954	92,299	677,790	6,909,152	128,092	6,510

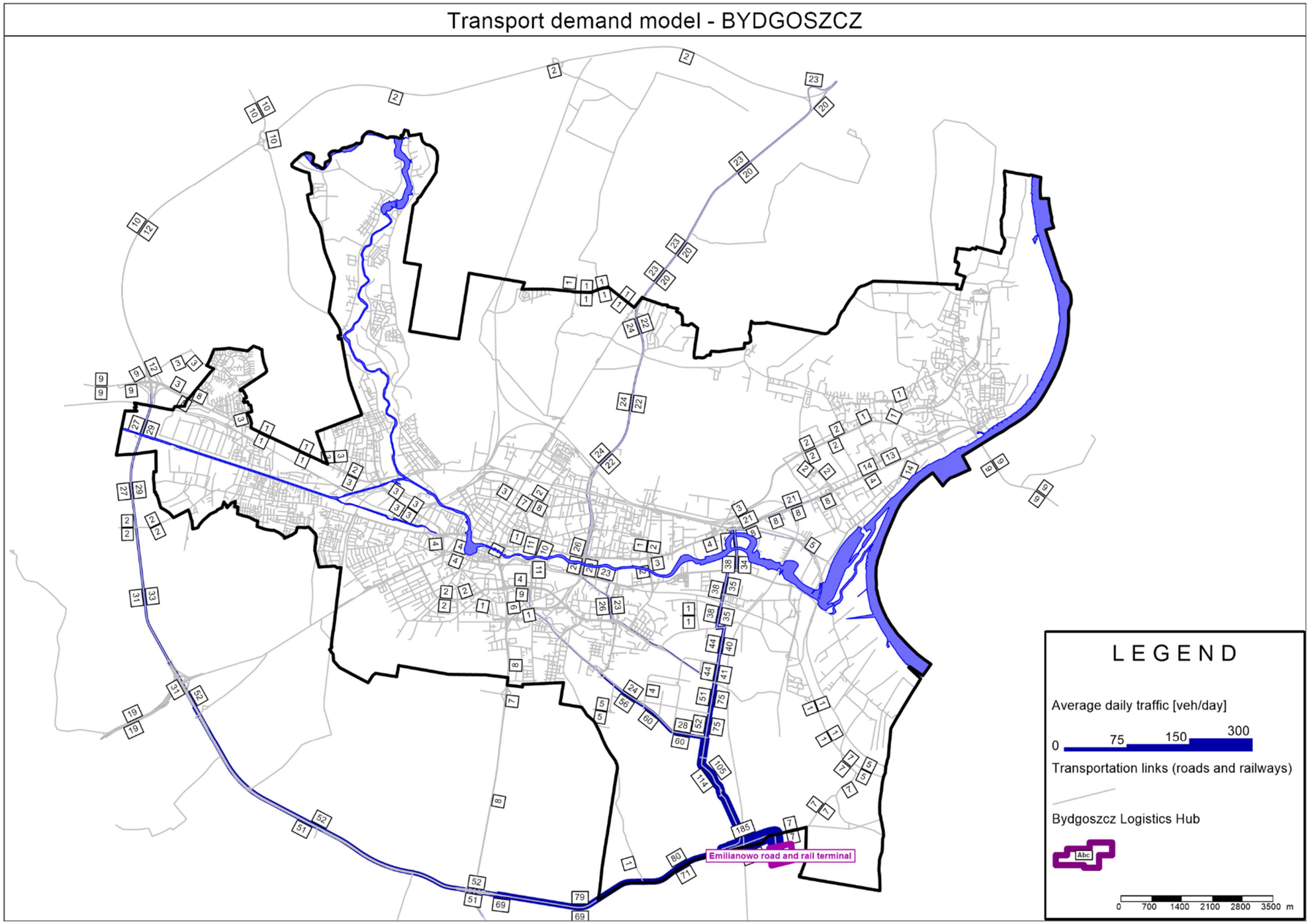


Fig. 7.2. Forecasted traffic volumes related to the multimodal terminal - investment variant 2025.

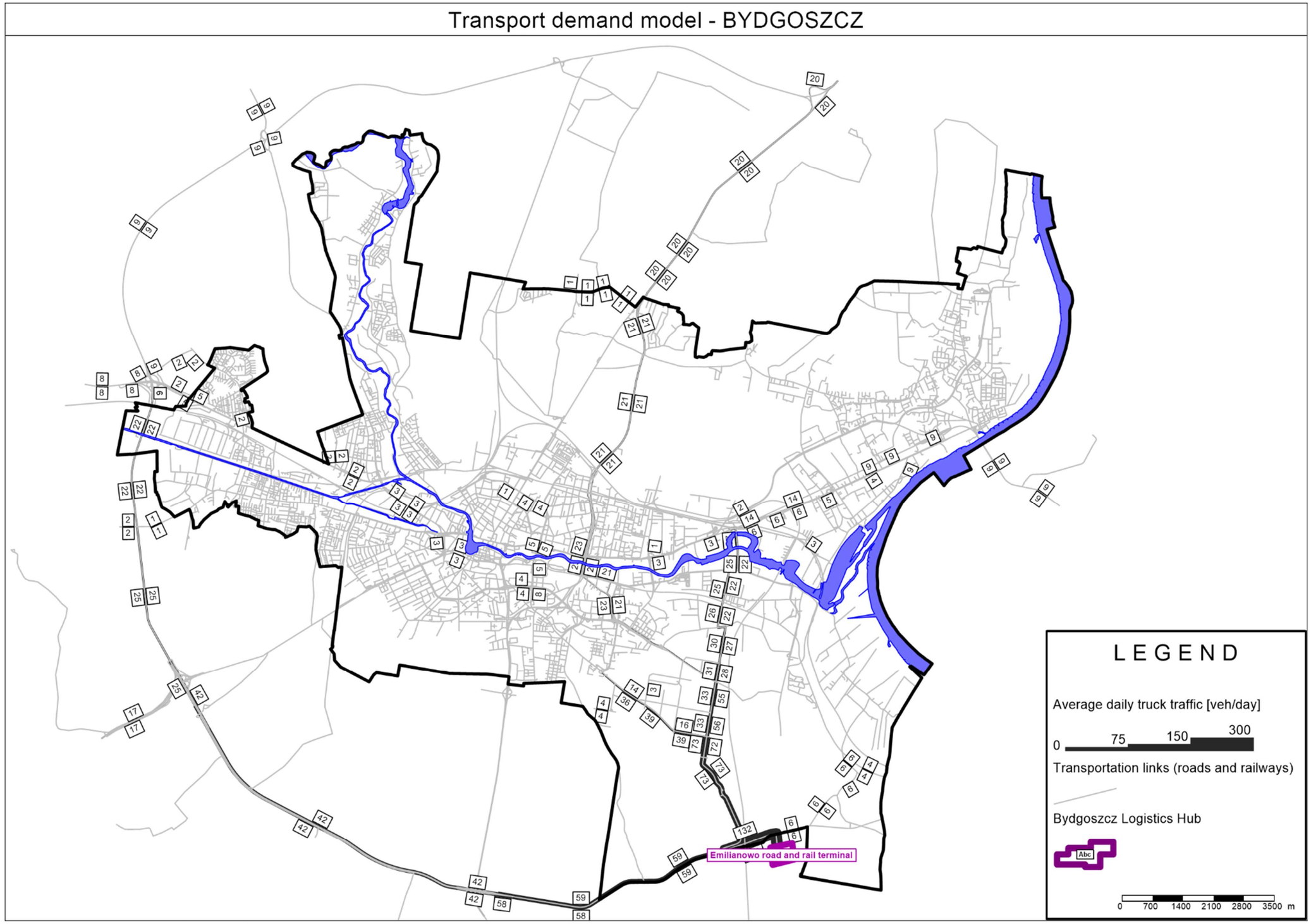


Fig. 7.3. Forecasted volume of truck traffic related to the multimodal terminal - investment variant 2025.

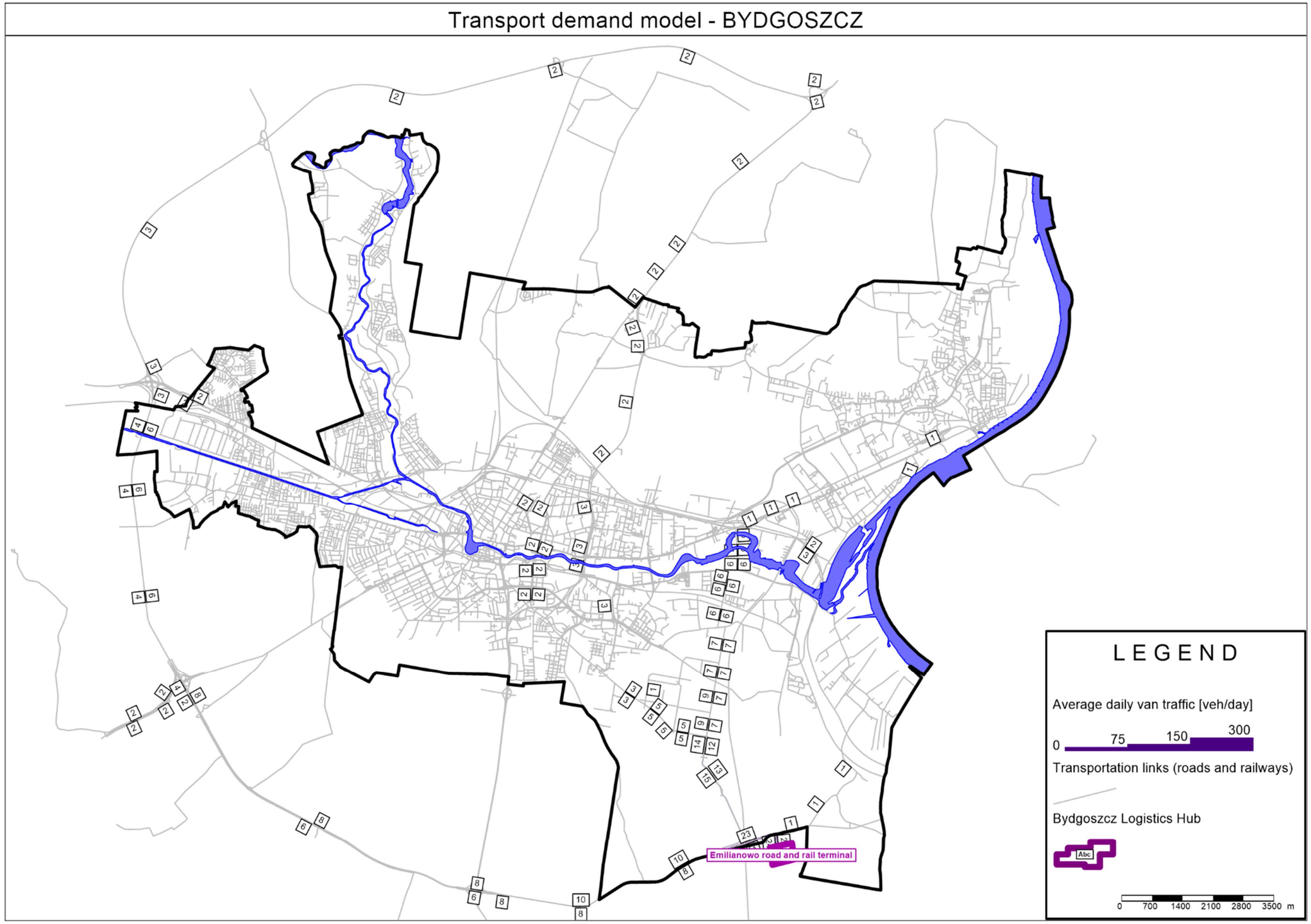


Fig. 7.4. Forecasted volume of van traffic related to the multimodal terminal - investment variant 2025.

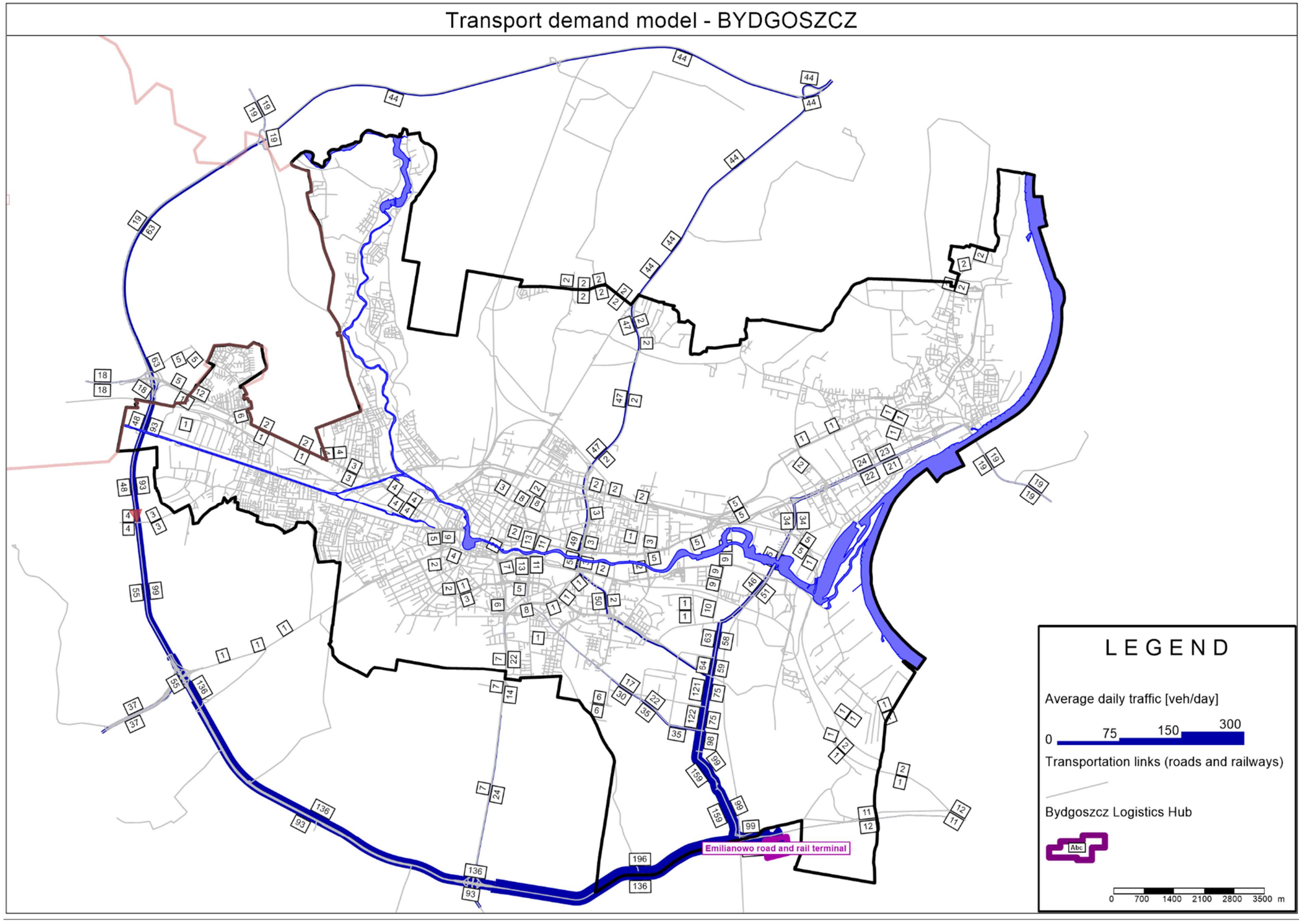


Fig. 7.5. Forecasted traffic volumes related to the multimodal terminal - investment variant 2030.

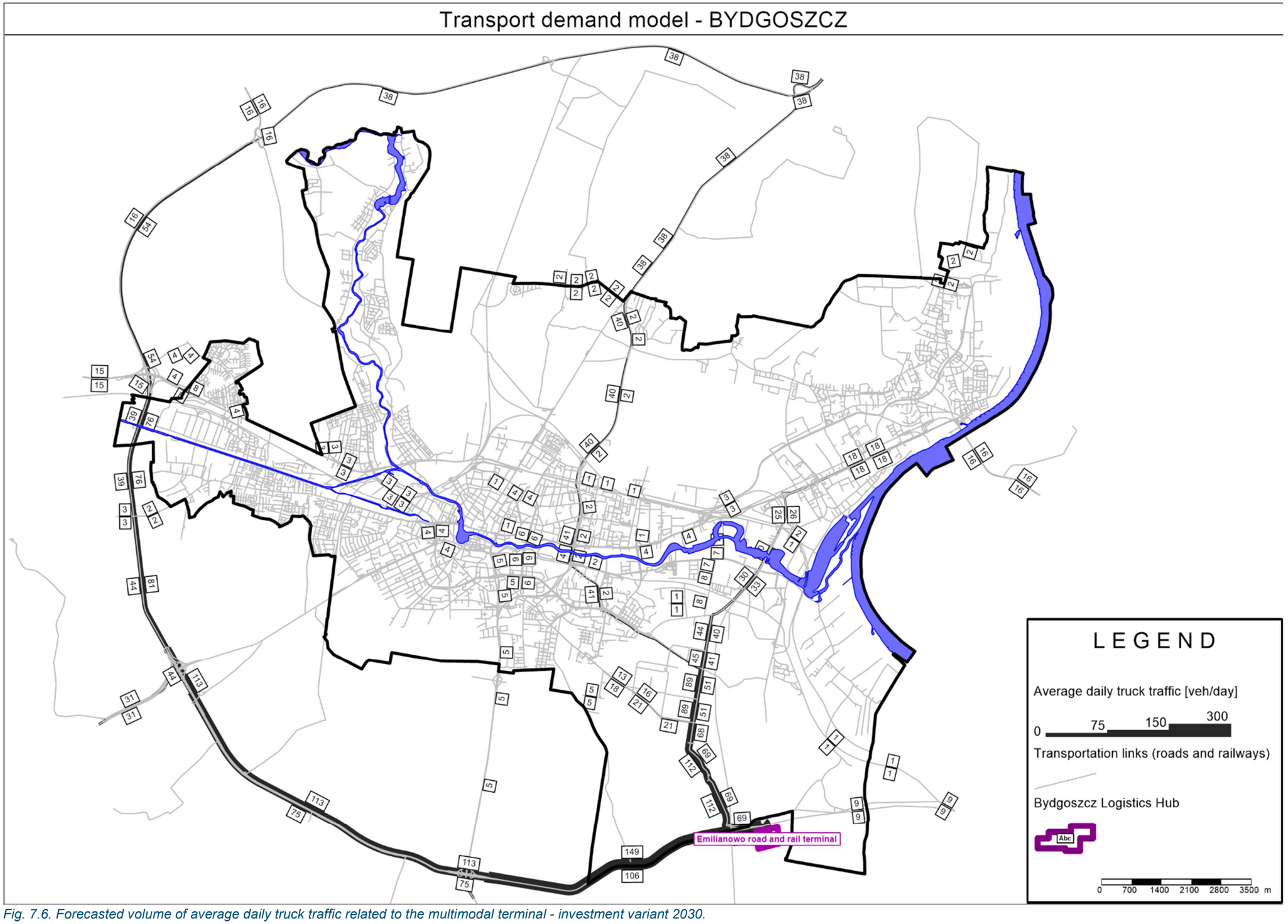


Fig. 7.6. Forecasted volume of average daily truck traffic related to the multimodal terminal - investment variant 2030.

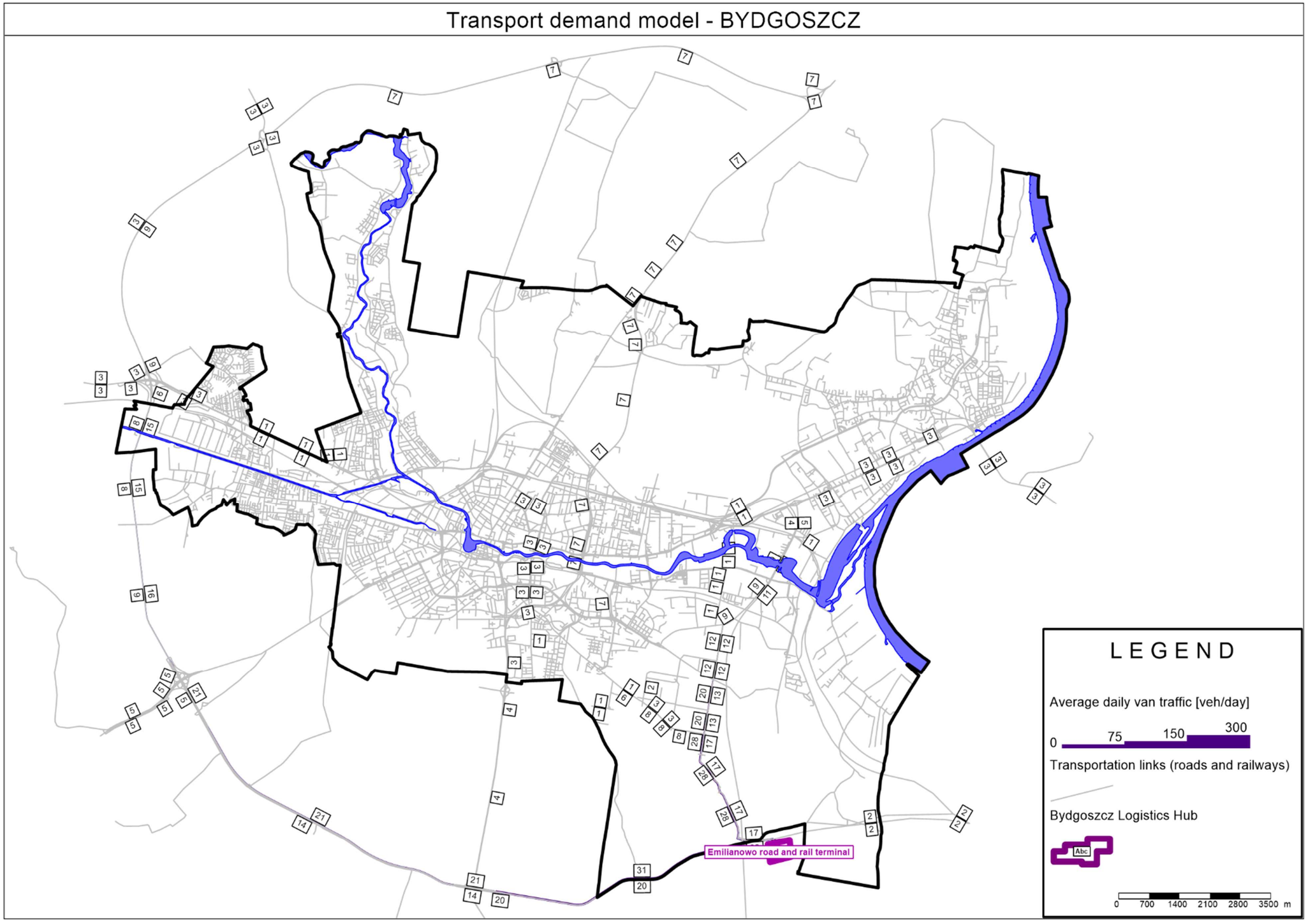


Fig. 7.7. Forecasted volume of vans traffic related to the multimodal terminal - investment variant 2030.

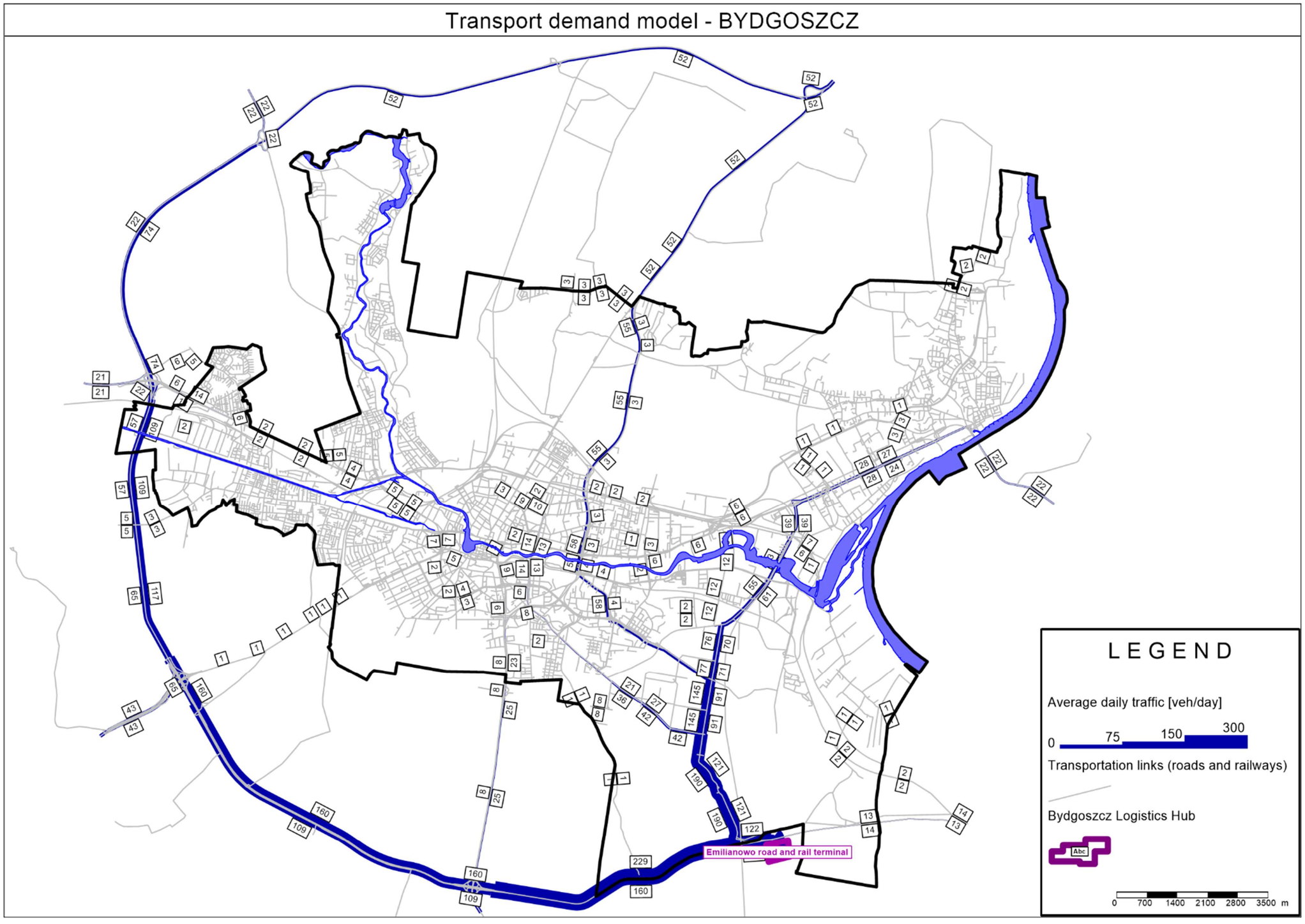


Fig. 7.8. Forecasted traffic volumes related to the multimodal terminal - investment variant 2035.

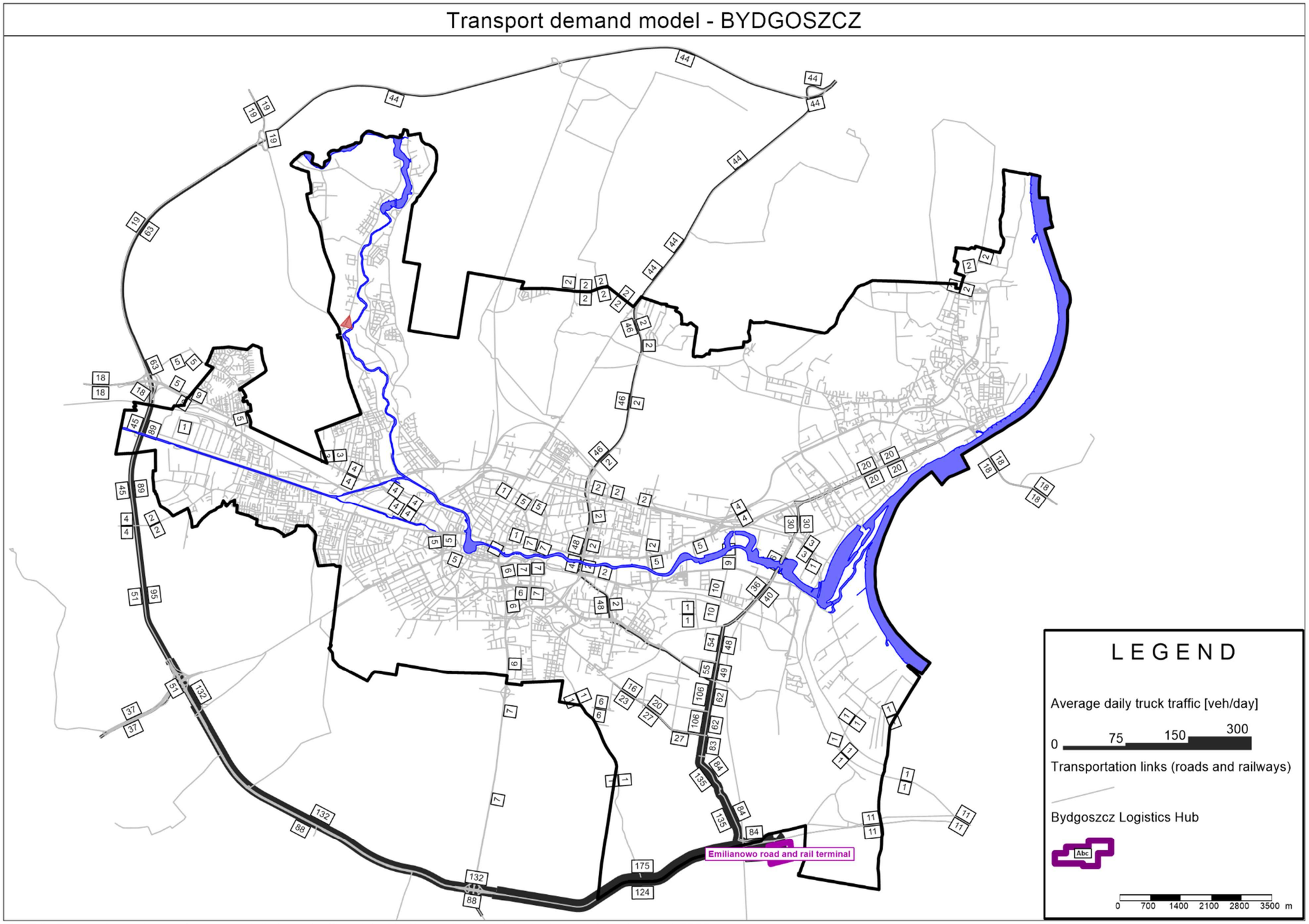


Fig. 7.9. Forecasted volume of average daily truck traffic related to the multimodal terminal - investment variant 2035.

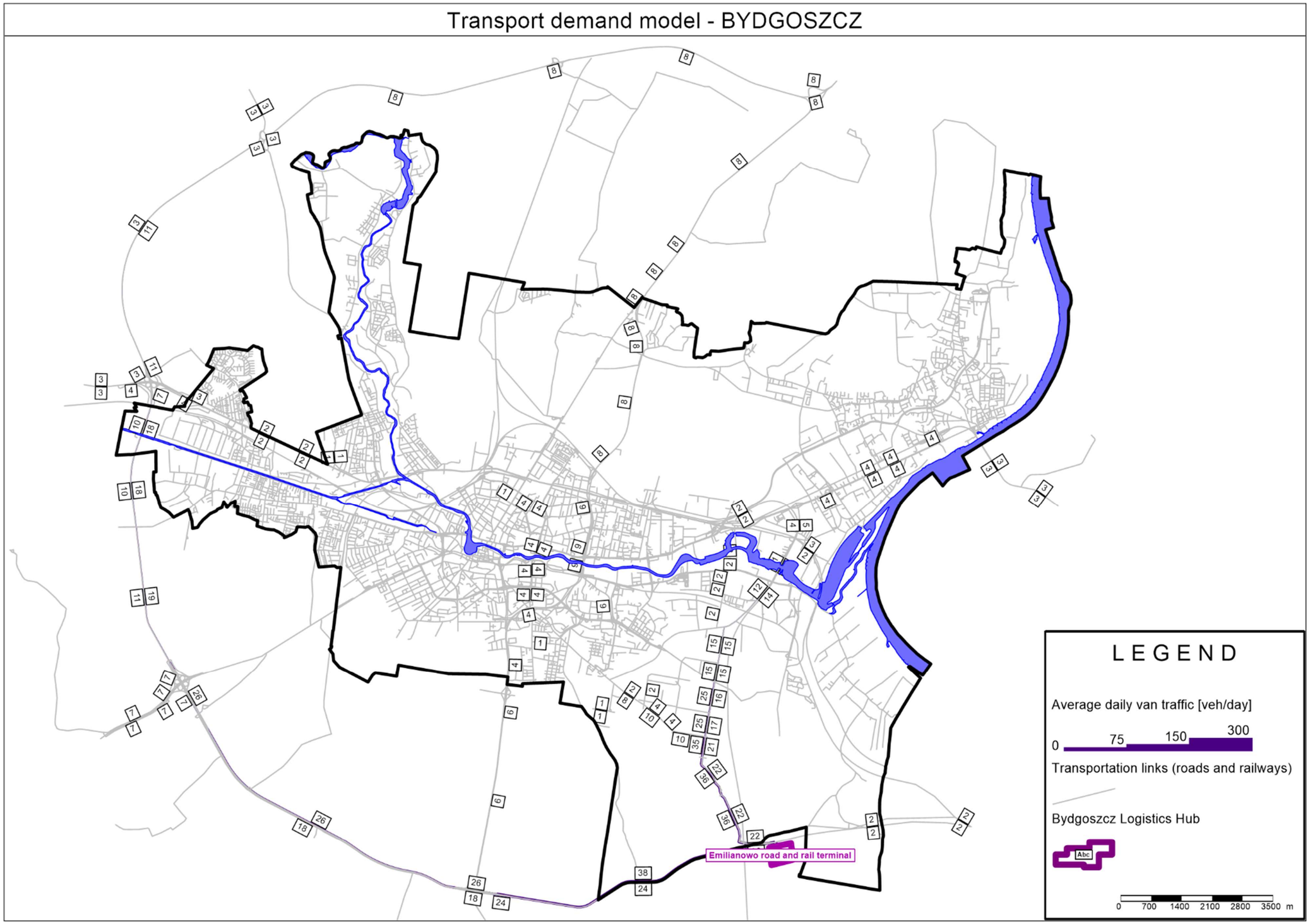


Fig. 7.10. Forecasted volume of average daily van traffic related to the multimodal terminal - investment variant 2035.

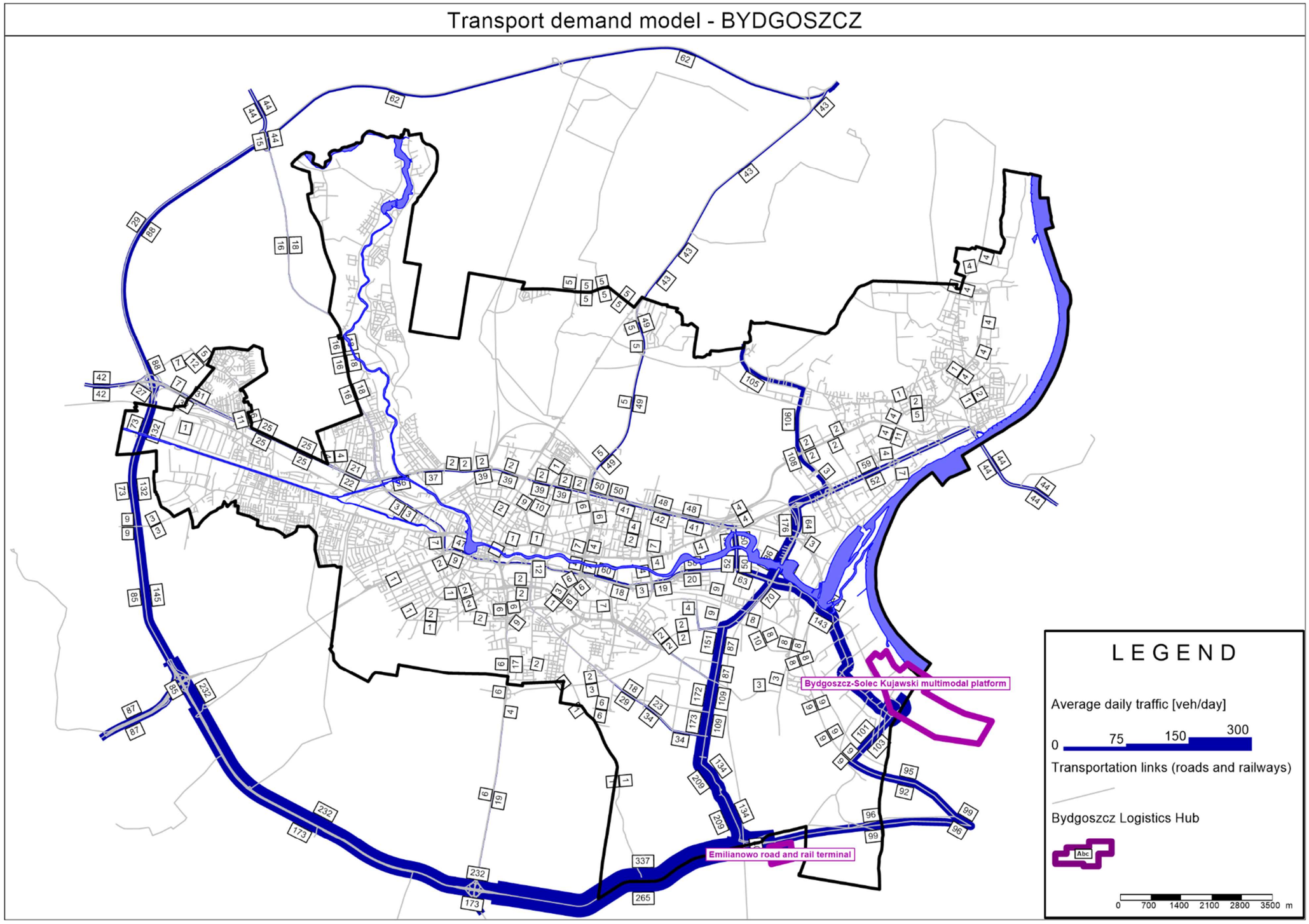


Fig. 7.11. Forecasted traffic volumes related to multimodal terminals - investment variant 2040.

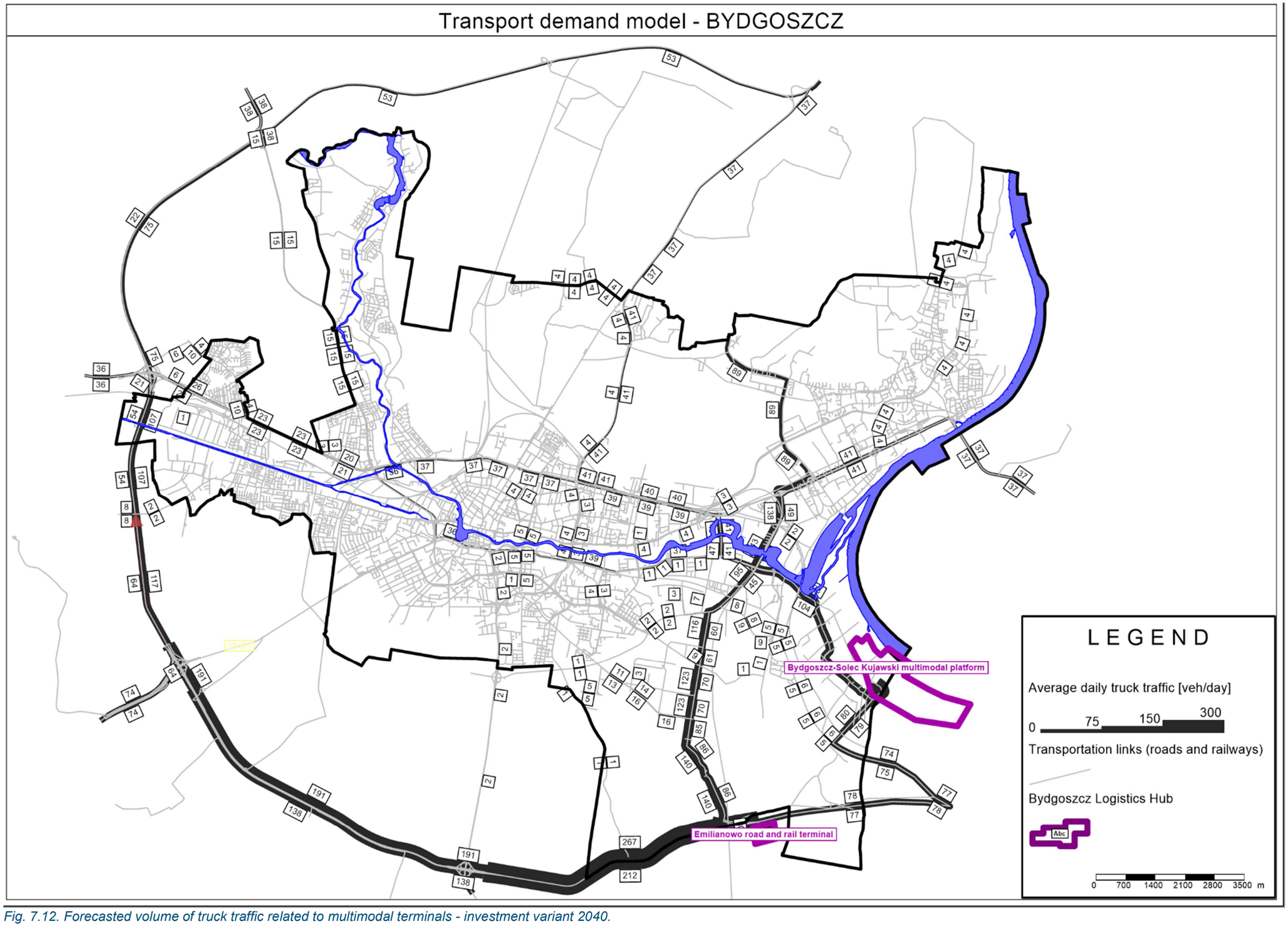


Fig. 7.12. Forecasted volume of truck traffic related to multimodal terminals - investment variant 2040.

Transport demand model - BYDGOSZCZ

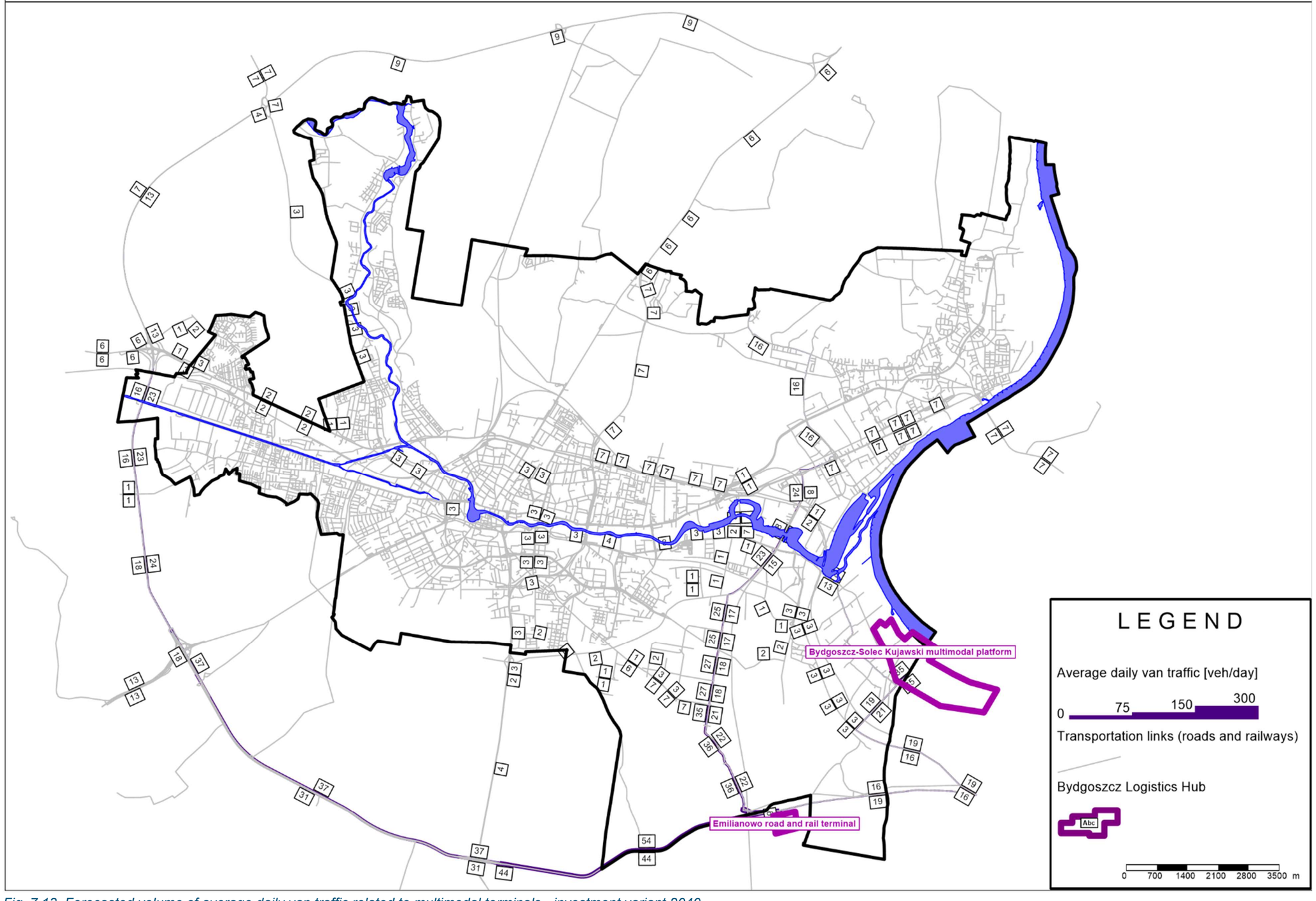


Fig. 7.13. Forecasted volume of average daily van traffic related to multimodal terminals - investment variant 2040.

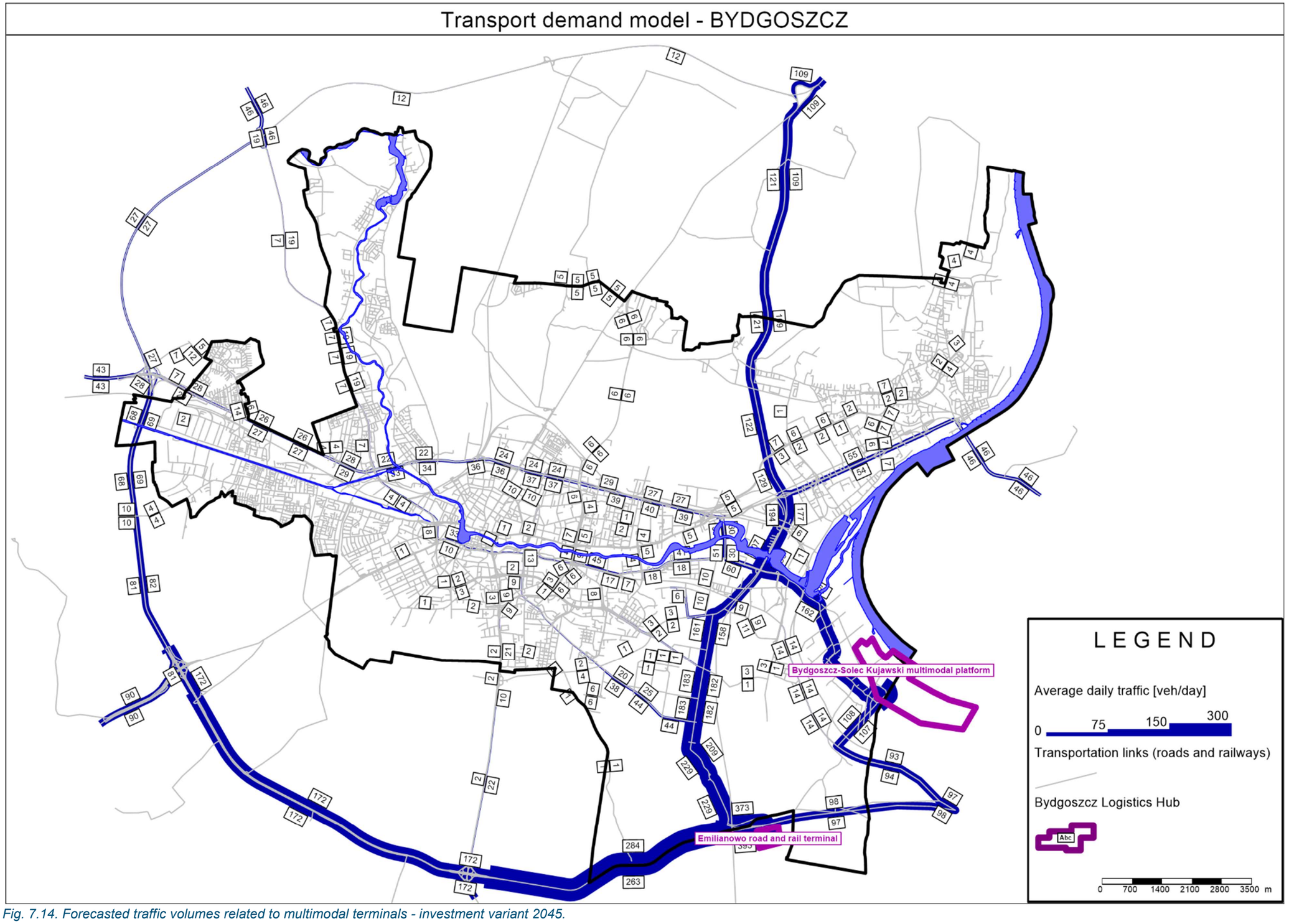


Fig. 7.14. Forecasted traffic volumes related to multimodal terminals - investment variant 2045.

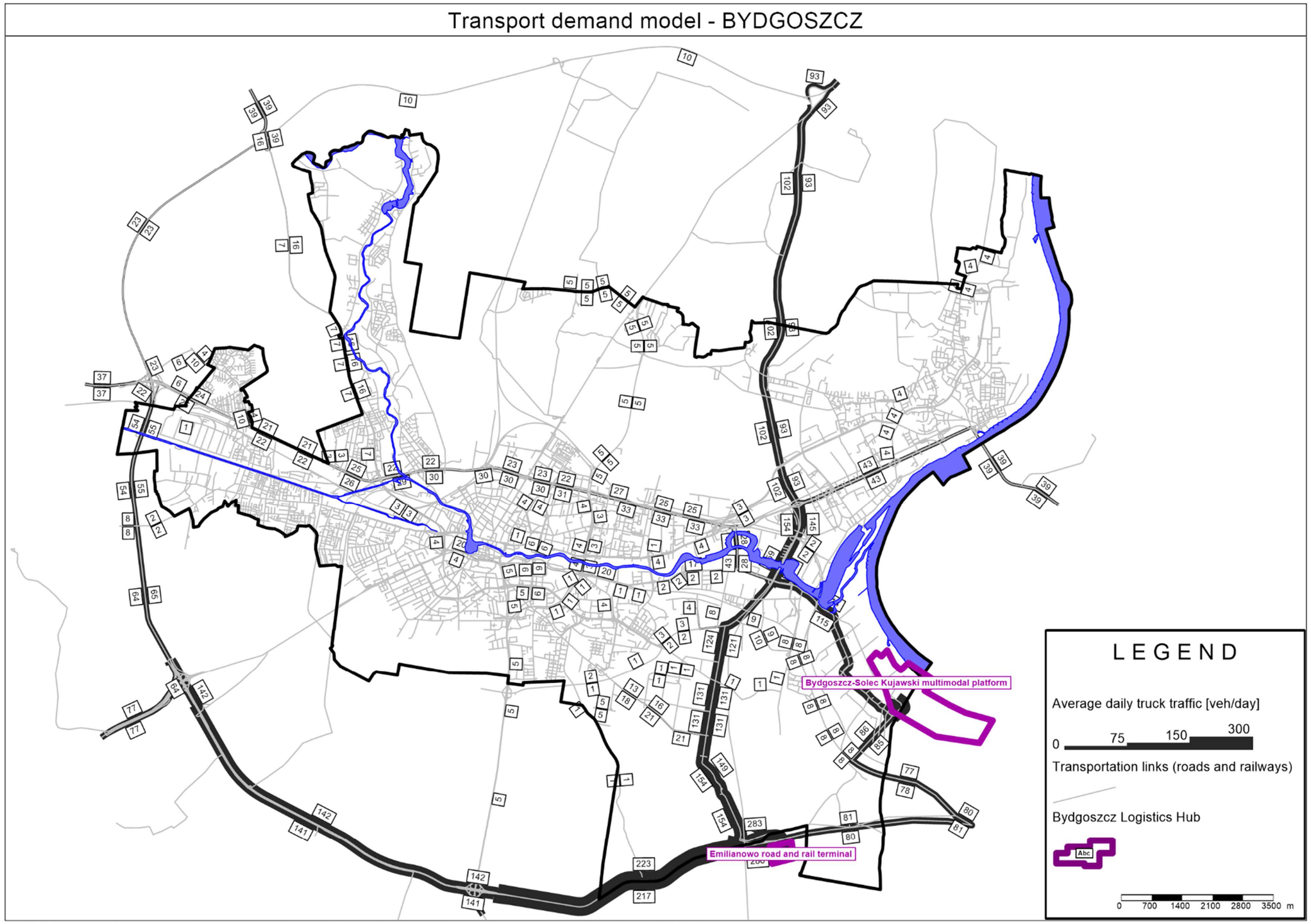


Fig. 7.15. Forecasted volume of average daily truck traffic related to multimodal terminals - investment variant 2045.

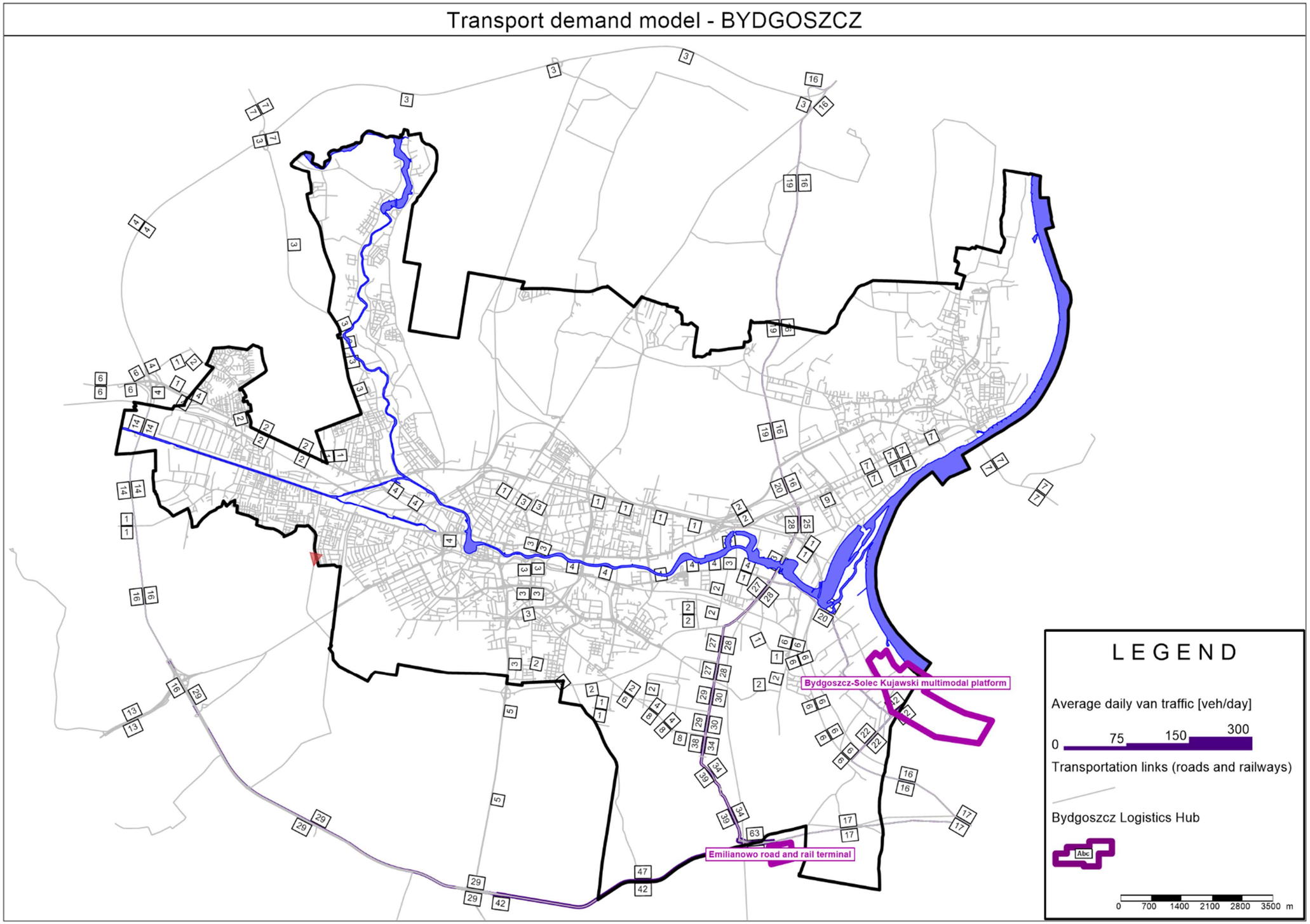


Fig. 7.16. Forecasted volume of average daily van traffic related to multimodal terminals - investment variant 2045.

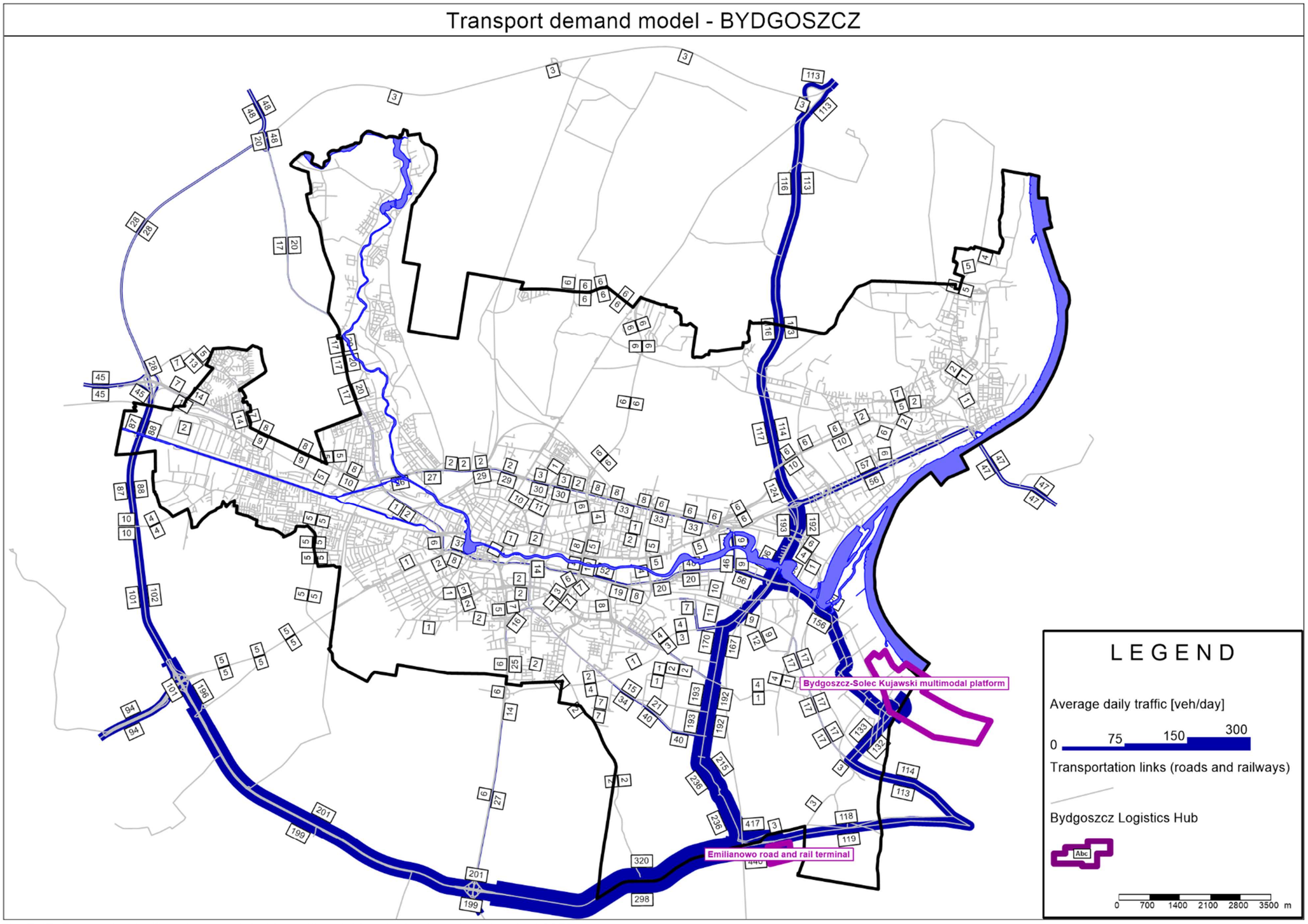


Fig. 7.17. Forecasted traffic volumes related to multimodal terminals - investment variant 2050.

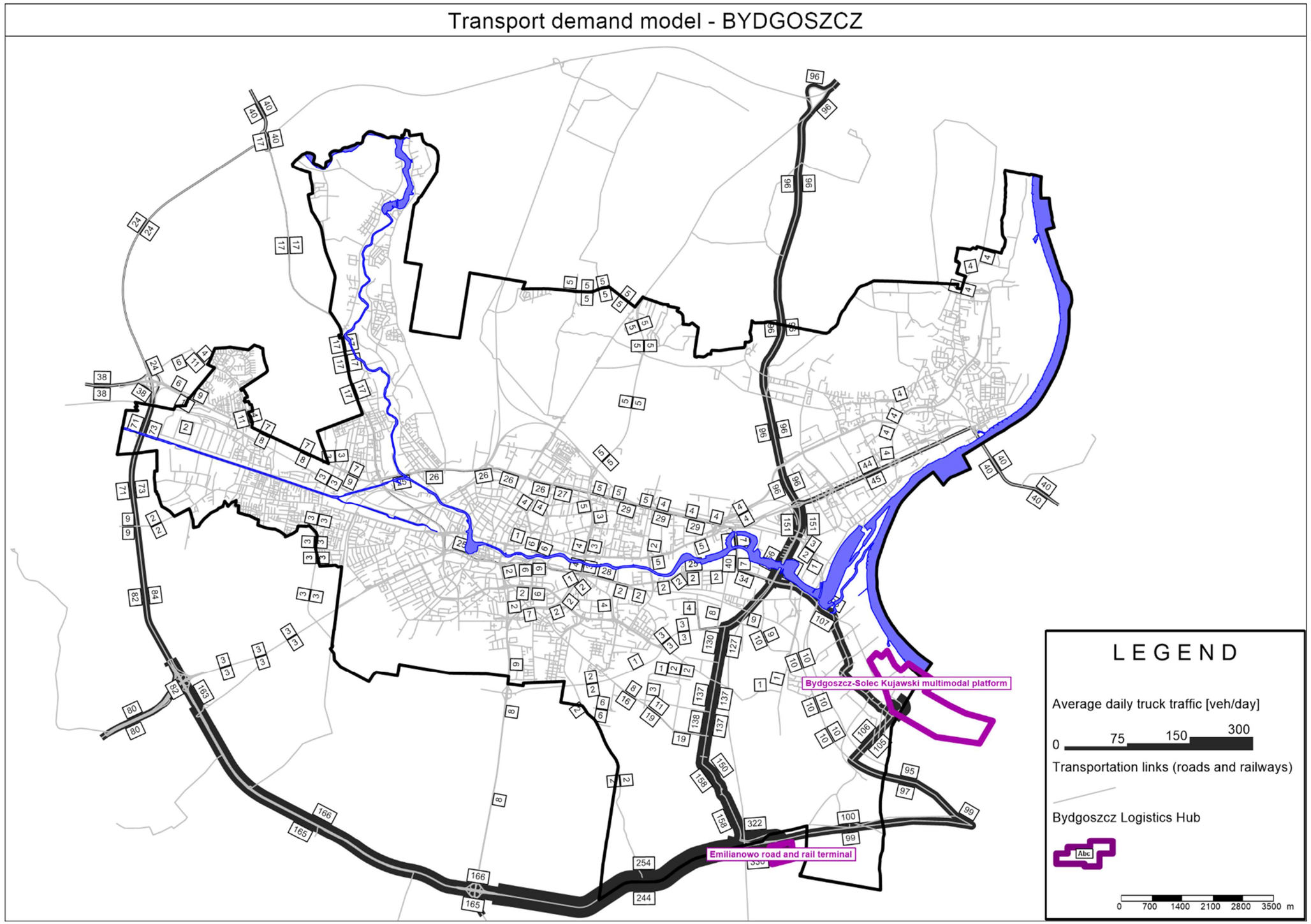


Fig. 7.18. Forecasted volume of average daily truck traffic related to multimodal terminals - investment variant 2050.

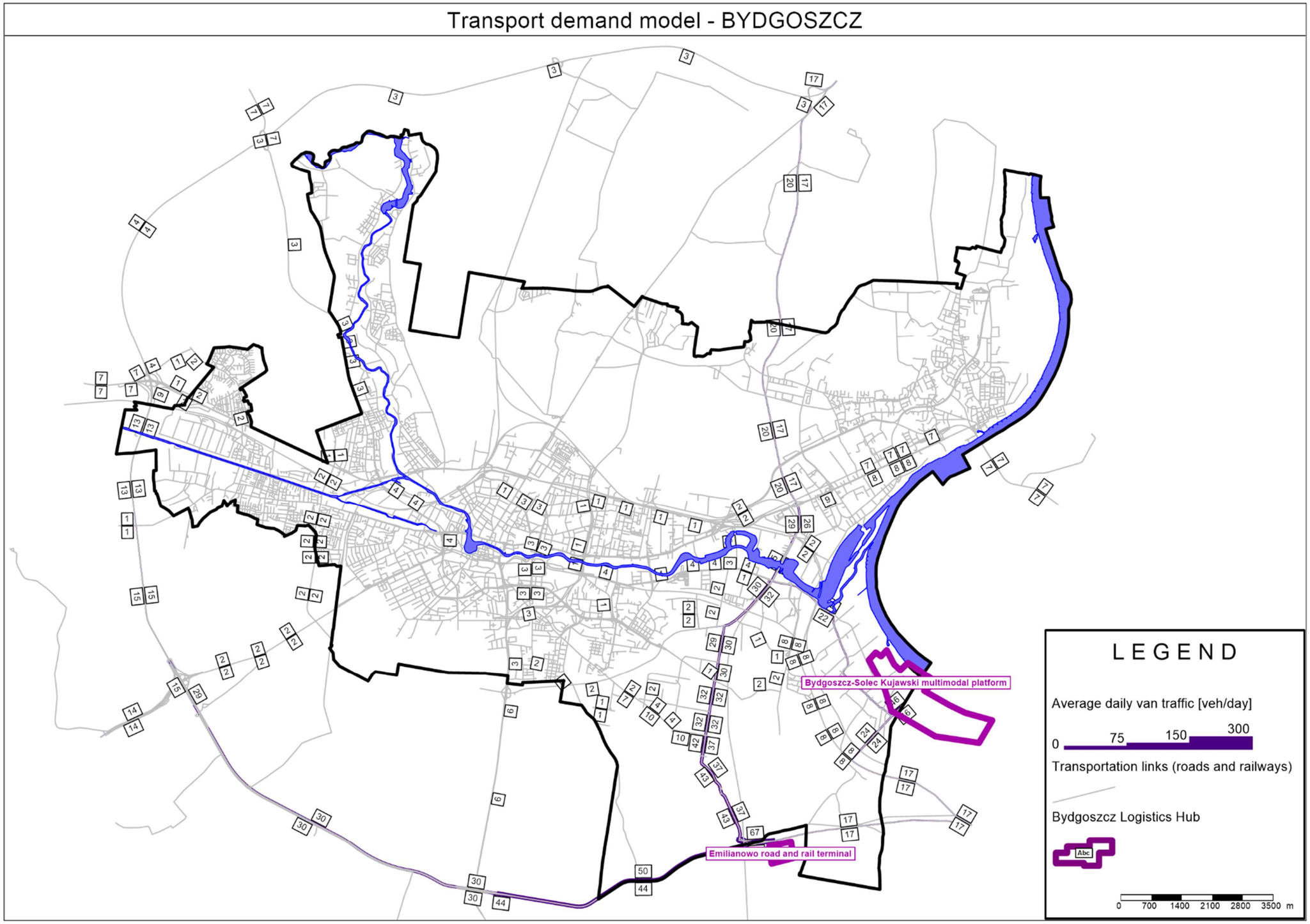


Fig. 7.19. Forecasted volume of average daily van traffic related to multimodal terminals - investment variant 2050.

7.5 TRAFFIC FORECAST SUMMARY

Based on the simulation analyzes, the following conclusions were drawn

1) Internal traffic of vans and trucks related directly to Bydgoszcz, carrying out journeys between production plants and logistics companies, changes in the years 2025-2050 in the range from 90 to 250, trucks and 10-44 vans during a working day. This accounts for approximately 9 to 24 trucks and 1-5 vans at peak times.
2) Trucks and vans from external areas on the west, north and east side additionally load the road network of the city of Bydgoszcz, they carry out journeys between sources (companies located outside the city) and the facilities of the Bydgoszcz logistics hub. To a large extent, these journeys are made by the S5 / S10 city bypass, but some traffic is a burden on the city network. According to the maps of truck traffic volume, daily traffic volume over 400 P/day is not expected to increase on a single section (39 at rush hour). At the same time, this means that the increase in road traffic resulting from the construction of multimodal ports should not constitute a significant obstacle in the city's transport network.
3) As a result of the construction of both facilities of the Bydgoszcz logistics hub, i.e. the Emilianowo railway terminal and the Bydgoszcz-Solec Kujawski multimodal platform, the average daily traffic volume on the city's network will increase slightly compared to the non-investment option, and the total transport work and time spent in the network will also increase, which is a direct result of the additional road traffic related to multimodal terminals. However, these changes are small and do not exceed 0.5% in the case of transport performance and 0.15% of the time spent on the road network.

8 MAIN RECOMMENDATIONS AND CONCLUSIONS

The results of the analyzes carried out as part of this study showed that the construction of the Emilianowo railway terminal and the Bydgoszcz - Solec Kujawski multimodal platform as part of the Bydgoszcz logistics hub will not significantly affect the functioning of the transport systems in the city. It is forecasted that changes in road traffic volumes on the city's road network will be caused mainly by truck and van traffic from areas external to the city, i.e. from the east, north and west of the city. Considering the nature of Bydgoszcz, where most of the industrial areas are located in the south-eastern part of the city (the Technology Park area), located in the immediate vicinity of the analyzed multimodal terminals, the impact of traffic generated by the city towards them will be negligible.

That being said, it is recommended to:

1) limit the transit traffic of trucks through the city by introducing signs directing this traffic to the city bypass.
2) check the load-bearing capacity of the pavement on the roads leading to the planned facilities of the Bydgoszcz logistics hub.
3) check the road gauge for the passage of trucks on the roads leading to the planned Emilianowo railway terminal and the Bydgoszcz - Solec Kujawski multimodal platform.
4) check the possibility (horizontal gauge and corridors at intersections) for the passage of trucks on the roads leading to the planned facilities of the Bydgoszcz logistics hub.

9 BIBLIOGRAPHY

[1] Alke E., Kaczor M., Mokrzański M., 2018. Poradnik w zakresie przeprowadzania ankietowego badania mobilności transportowej ludności. Zakład Wydawnictw Statystycznych Warszawa.

[2] Batista S., 2017. A dynamic traffic assignment model based on the Prospect User Equilibrium. International Congress on Engineering – A Vision for the Future, At Covilhã, Portugal.

[3] Ben-Akiva M., Bierlaire M., 1999. Discrete Choice Methods and Their Applications to Short Term Travel Decisions. [W:] Handbook of transportation science, red. R.W. Hall, Springer Science + Business Media New York, 5–34.

[4] Biuro zrównoważonej mobilności UMW, 2018. Kompleksowe Badania Ruchu we Wrocławiu i otoczeniu – KBR 2018. Urząd Miejski Wrocławia, Wrocław.

[5] Cascetta E., 1997. National Modelling in Italy: Simulation and Evaluation Models for the Italian DSS. Seminar on National Transport Models: The State of the Art, Noordwijk.

[6] Cascetta E., 2009. Transportation Systems Analysis: Models and Applications. Springer New York – Dordrecht – Heidelberg – London.

[7] Castiglione J., Bradley M., Gliebe J., 2015. Activity-Based Travel Demand Models: A Primer. Transportation Research Board Washington. DOI: 10.17226/22357.

[8] Chmielewski J., Kempa J., 2019. Case Study – Benefits from Constructing a Grade-Separated Interchange. IOP Conference Series: Materials Science and Engineering. DOI: 10.1088/1757-899X/471/10/102067.

[9] Chmielewski J., Szczuraszek T., 2019. Wybrane problemy modelowania podróży w sieciach transportowych. Wydawnictwa Uczelniane UTP Bydgoszcz.

[10] Comi A., Delle Site P., Filippi F., Nuzzolo A., 2012, Urban Freight Transport Demand Modelling: a State of the Art, European Transport 51/XVII, URL: http://hdl.handle.net/10077/6123.

[11] Chu Z., Cheng L., Chen H., 2012. A Review of Activity-Based Travel Demand Modeling. CICTP 2012: Multimodal Transportation Systems – Convenient, Safe, Cost-Effective, Efficient – Proceedings of the 12th COTA International Conference of Transportation Professionals, Beijing, China, 48–59.

[12] Crevo C.C., 1991. Impacts of zonal reconfigurations on travel demand forecasts. Transportation Research Record 1477, 72–80.

[13] de Dios Ortúzar J., Willumsen L.G., 2011. Trip Distribution Modelling. [W:] J. de Dios Ortúzar, L.G. Willumsen, Modelling Transport, John Wiley & Sons Ltd Chichester, DOI: 10.1002/9781119993308.ch5.

[14] Fiorello D., Martino A., Zani L., Christidis P., Navajas-Cawood E., 2016. Mobility Data across the EU 28 Member States: Results from an Extensive CAWI Survey. Transportation Research Procedia 14, 1104–1113.

[15] Gonzalez-Feliu J., Routhier J-L., Modeling Urban Goods Movement: How to be Oriented with so Many Approaches?, 2012, Procedia - Social and Behavioral Sciences, Volume 39, Pages 89-100, DOI: 10.1016/j.sbspro.2012.03.093.

[16] Hueber S., Klauenberg J., Thaller C., 2015, Consideration of transport logistics hubs in freight transport demand models, European Transport Research Review, Springer 32, DOI: 10.1007/s12544-015-0181-5.

[17] Ibeas A., Moura J.L.,Nuzzolo A., Comi A.,2012, Urban Freight Transport Demand: Transferability of Survey Results Analysis and Models Procedia - Social and Behavioral Sciences Volume 54, Pages 1068-1079, DOI: 10.1016/j.sbspro.2012.09.822.

[18] Jacyna M., Szarata A., 2016. Warszawskie Badanie Ruchu 2015 wraz z opracowaniem modelu ruchu. Raport z etapu IV. Politechnika Warszwska/Politechnika Krakowska Sopot – Kraków – Warszawa.

[19] Karlsruhe, 2018. PTV VISUM 18. New Features at a Glance. PTV AG, Karlsruhe.

[20] Karwasz M., Szczuraszek T., 2018. Transport attractiveness of shopping malls. Technical Transations 115(7), 101–112, DOI 10.4467/2353737XCT.18.103.8798.

[21] Kulpa T., Kucharski R., Szarata A., 2016. Budowa regionalnych modeli transportowych – założenia i dylematy. Transport of the 21st Century 111, 347–356.

[22] Litman T., 2019. Generated Traffic and Induced Travel. Implications for Transport Planning. ITE Journal 71(4), 38–47.

[23] National Guidelines for Transport System Management, 2016. Travel Demand Modelling. T1. Transport and Infrastructure Council Canberra.

[24] Profillidis V.A., Botzoris G.N., 2019. Modeling of Transport Demand. Analyzing, Calculating, and Forecasting Transport Demand. Elsevier Amsterdam – Oxford – Cambridge. DOI: 10.1016/c2016-0-00793-3.

[25] Saberi M., Mahmassani H.S., Brockmann D., Hosseini A., 2017. A complex net-work perspective for characterizing urban travel demand patterns: graph theoretical analysis of large-scale origin-destination demand networks. Transportation 44(6), 1383–1402.

[26] Studium lokalizacyjne dla zamierzenia inwestycyjnego' pn.: „Platforma multimodalna oparta na transporcie wodnym, kolejowym, drogowym i lotniczym z centrum logistyczno-magazynowym i portem rzecznym zlokalizowanym na wskazanym obszarze lewego brzegu WISŁY (km 766-771), z uwzględnieniem obszaru miasta Bydgoszczy i Gminy Solec Kujawski.", 2019

[27] Szaciłło L., Zielaskiewicz H., 2019, Rozwój przewozów intermodalnych w województwie kujawsko-pomorskim na przykładzie projektu budowy terminala intermodalnego w Emilianowie, Przegląd komunikacyjny nr 12/2019, rocznik LXXIV.

[28] Udo H., 2018. The setup, calibration and validation of strategic transport models. The transport demand model of the State of Bavaria. Warsaw.

[29] Urząd Miasta Bydgoszczy, 2019, Bydgoszcz w liczbach 2019, UM Bydgoszcz.

[30] Wang L., Xue X., Zhao Z., Wang Z., 2018. The Impacts of Transportation Infrastructure on Sustainable Development: Emerging Trends and Challenges. International Journal of Environmental Research Public Health 15(6), 1172. DOI: 10.3390/ijerph15061172.

.

10 LIST OF TABLES AND FIGURES