Analysis of the possibilities of integrating bus transport in the Warsaw Metropolis

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The analysis in question is consistent with the assumptions presented in the "Sustainable Urban Mobility Plan for the Warsaw Metropolis 2030+ (SUMP)"

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LIST OF TERMS AND ABBREVIATIONS

Urban agglomeration	A group of towns and settlements clustered around a large city or industrial center. Agglomeration refers to the spatial structure (the combination of cities and settlements), as opposed to metropolis, which refers to the meaning and function of the city in a broader context.
B+R, B&R	Bicycle parking allowing you to leave your vehicle and continue your journey by public transport (*Bike and Ride*).
BKM	Free public transport.
CNG	Compressed natural gas.
FRPA	Government Fund for the Development of Bus Transport of a public utility nature, established by the Act of March 16, 2019 to co-finance restored bus connections.
GTFS	International format for recording information on timetables and stop locations (*General Transit Feed Specification*).
JST	Unit of local government: commune, district, province.
JST MW	Communes and districts that are members of the Warsaw Metropolis Association.
K+R, K&R	A place for cars intended for a short stop in order to take a passenger to the destination or transfer point to another means of transport (*Kiss and Ride*).
LNG	Liquefied natural gas.
MINI	A class of bus that is up to 8.99 m long.
MIDI	A class of bus that ranges from 9 to 10.99 m in length.
MAXI	A class of bus that ranges from 11 to 13 m in length.
MEGA	A class of bus whose length is from 13 to 16 m (MEGA15) or from 16 to 18.75 m (MEGA18).
MW	Warsaw Metropolis.
GPA	Grodzisk Bus Transport. A district-commune Union that organises bus transport in 3 districts and 18 communes.
Metropolitan area[1]	A spatially coherent zone of influence of a city that is the seat of a voivode or a voivodeship assembly, characterised by the existence of strong functional connections and advanced urbanisation processes, inhabited by at least 500,000 inhabitants.
PTZ operator	A local government budgetary institution and an entrepreneur authorised to conduct business activity in the field of passenger transport who has concluded an agreement with the Organiser of public collective transport for the provision of services in the field of public collective transport on the communication line specified in the agreement.

[1]Act of October 9, 2015 on metropolitan unions

GPA operators	Entities providing transport services within the network organised on behalf of GPA. GPA Operators: Automotive Communication Enterprise in Grodzisk Mazowiecki Sp. z o.o., PKS Tarnobrzeg Sp. z o.o., PKS Bodzentyn Sp. z o.o.
ZPGOPGP operators	Entities providing transport services within the network organised on behalf of ZPGOPGP. Operators of the ZPGOPGP: Janusz Wołoszka - Transport Services, Wołoszka Sp. z o.o.
PGZTPPM operators	Entities providing transport services within the network organised on behalf of the PGZTPPM. PGZTPPM operators: MESIO Transport Services Dariusz Gańko[2].
ZTM operators	Entities providing transport services within the WTP network organised on behalf of ZTM in Warsaw. ZTM bus operators: Miejskie Zakłady Autobusowe Sp. z o.o. in Warsaw, MOBILIS Sp. z o.o., Przedsiębiorstwo Komunikacji Samochodowej in Grodzisk Mazowiecki Sp. z o.o., Komunikacja Miejska Łomianki Sp. z o.o., RELOBUS Transport Polska Sp. z o.o.
PTZ organiser	The appropriate local government unit or the minister responsible for transport, ensuring the operation of public transport in a given area; the organiser of public transport is the "competent authority".
P+R, P&R	"Park and Ride" Parking. Parking allowing you to leave your car and continue your journey efficiently by public transport.
PGZTPPM	District-Commune Public Transport Union of Mińsk District. A district-commune Union that organises bus transport in the 13 communes of Mińsk district.
Carrier	An entrepreneur authorised to conduct business activity in the field of passenger transport on the basis of a permit to perform regular passenger transport in domestic road transport.
PTZ	Public collective transport. Publicly available regular passenger transport performed at specified time intervals and on a specified communication route, communication lines or communication network.
SDIP	Dynamic Passenger Information System. An information system providing current information on vehicle arrivals, delays, changes in routes and other important travel-related messages presented on electronic information media (e.g. LED/LCD boards).
Warsaw Metropolis Association	An association of communes and districts located in the Capital Warsaw Region, defined as NUTS 2, which includes the City of Warsaw, 69 communes and 9 districts.
PTZ Act	Act of December 16, 2010 on public transport.
ZPGOPGP	Otwock District-Commune Transport Union. A district-commune Union that organises bus transport in 7 communes of Otwock district and 1 commune of Piaseczno district.

[2]As of September 30, 2024

ZTM in Warsaw	Warsaw Public Transport Authority. Organiser of public transport in the City of Warsaw and 33 Communes of the Warsaw Metropolis.
District/commune Union	A unit created by the distict(s) and communes for the purpose of jointly performing public tasks, including issuing decisions in individual cases within the scope of public administration.

1. INTRODUCTION

The public transport system is an extremely important element of the activities of a local government unit. Travel by residents, regardless of the distances covered, is an everyday occurrence, and the organisation of public transport allows for their significant improvement. The development of public transport is therefore one of the key issues in the development of a local government unit. It is also worth noting that travel takes place not only within the administrative boundaries of one commune or town - travel has no borders, so cooperation between local government units is extremely important here. Understanding the value of an integrated public transport system and its link to the sustainable development of the entire metropolitan area is key to implementing further fruitful actions aimed at improving the quality of life of its residents.

The current shape of the public transport network in the Warsaw Metropolitan Area, one of the basic branches of which is bus transport, results from many historical and economic changes. The noticeable functional fragmentation of bus transport was caused by the specific wording of the legal provisions of the PTZ Act, which defined a very strongly dispersed system of Organisers of this type of transport. In Poland, there are concepts of urban transport, commune, district, district-commune, metropolitan, voivodeship and inter-voivodeship transport. The current lack of requirements and incentives for local government units (in terms of, e.g., financing of PTZ) has resulted in the above-mentioned significant fragmentation of transport organisation, which has led to the deformation of the bus transport system in the metropolis in terms of tariffs, schedules and quality.

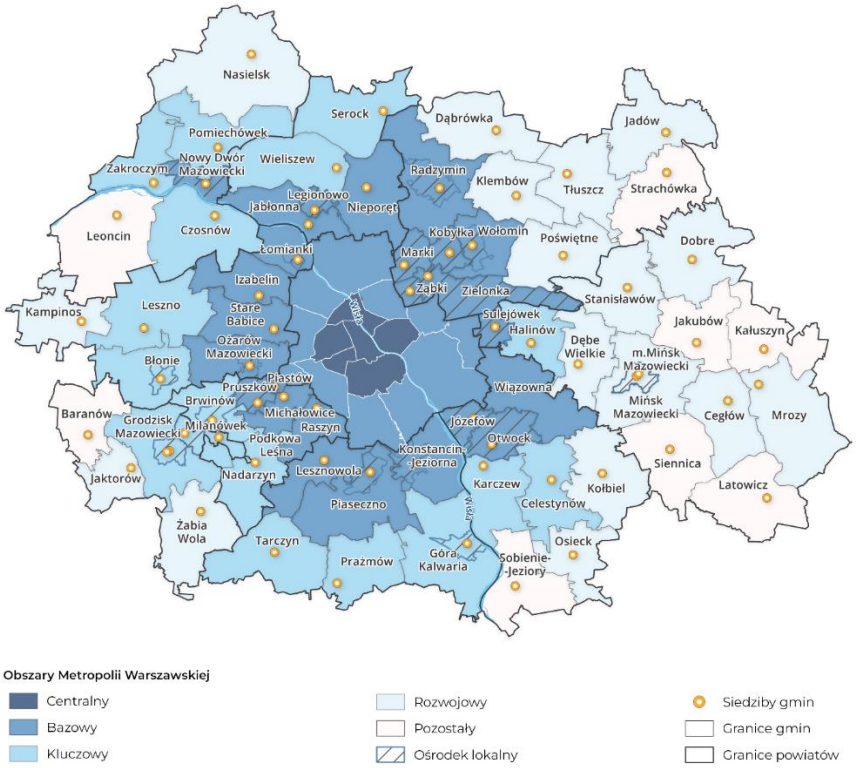
This study has been divided into two parts – inventory and planning. The first one focuses on identifying the current bus transport offer in the area of the City of Warsaw, 69 communes and 9 districts located in the Warsaw Metropolitan Area understood as the Warsaw Capital Region[3]. The inventory part was the starting point for the second stage of work, within which a plan for the integration of bus transport in terms of information and tariffs was proposed.

[3]according to the NUTS 2 statistical classification

1.1. AREA OF ANALYSIS

In the case of the Warsaw Metropolitan Area, which has approximately 3.2 million inhabitants, an efficient, reliable and uniform public transport system is key to the proper functioning and development of all local governments located within its territory. **The core layout of the** area influences the relatively clear traveller traffic, which is usually in the direction from and to the capital (see: Map 2.). This does not mean that the importance of commune or inter-commune lines is ignored, as connections outside the metropolitan core are also important. In the further parts of the study, the so-called **local centres** will be highlighted, which play a significant role for smaller towns. Centers of this type are usually district towns, where the largest employers, educational institutions and service and commercial centers are located.

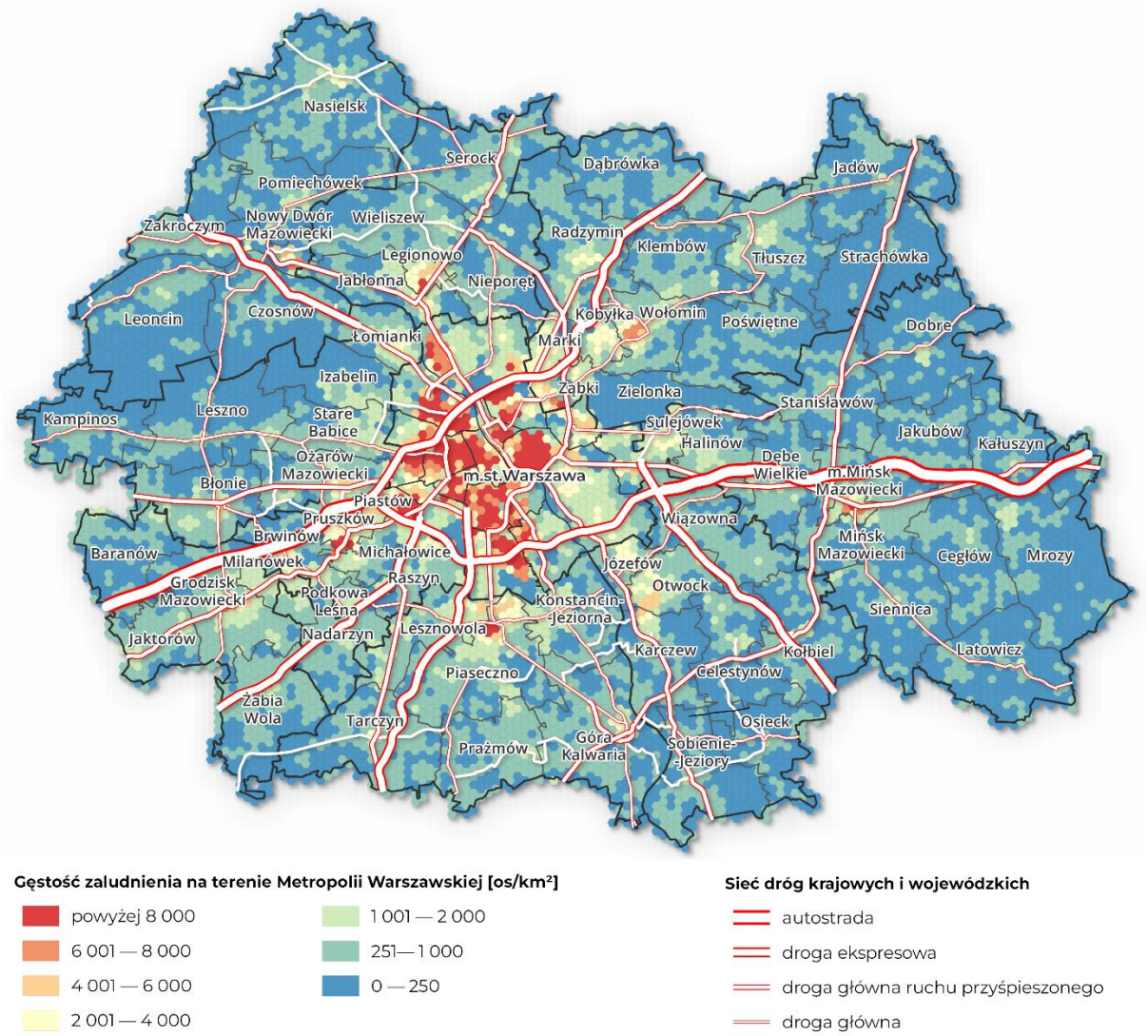
Map 1. Warsaw Metropolis



Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on SUMP MW

PL	EN
Centralny	Central
Bazowy	Base
Kluczowy	Key
Rozwojowy	Developmental
Pozostały	Other
Ośrodek lokalny	Local centre
Siedziby gmin	Commune seats
Granice gmin	Commune boundaries
Granice powiatów	District boundaries
Obszar Metropolii Warszawskiej	Warsaw Metropolitan Area

Map 2. Population density in MW



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Gęstość zaludnienia na terenie Metropolii Warszawskiej [os/km2]	Population density in the Warsaw Metropolitan Area [people/km2]
Powyżej	Above
Sieć dróg krajowych i wojewódzkich	National and provincial road network
Autostrada	Motorway
Droga ekspresowa	Expressway
Droga główna ruchu przyśpieszonego	Main expressway
Droga główna	Main road

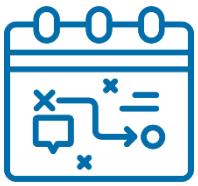
1.2. AIM OF THE STUDY

The analysis of the possibilities of integrating bus transport in the Warsaw Metropolitan Area is a study that aims to answer the question: "is such a complex and complicated process possible?" and "how to implement it?". The basis of the study is an inventory of existing bus connections along with the identification of their Organisers and operators as well as commercial carriers providing bus connections, as well as determining the quality of access to transport information. Next, the document presents a plan for the integration of the public bus transport offer within the metropolitan area.

The aim of the new system of organising public transport (of which bus transport is a part) should be to ensure high-quality service. A product such as bus transport must respond to social expectations and, with its quality, provide a clear and competitive alternative to everyday travel by private car.

The basis for developing the system should be the creation of a uniform network of connections that will effectively ensure the possibility of traveling throughout the entire metropolitan area. Passengers should be able to use the system using an integrated and simple tariff that will allow for convenient travel on many means of public transport available in the metropolis. Everyone should also have access to information, e.g. by creating a central database containing information on the functioning of the PTZ system in the metropolis, as is the case today in the network organised by the Warsaw ZTM. This data should be available to passengers, enabling travel planning for all modes of transport. These are the basic advantages of communication integration, which is the subject of this document.

The key determinants of travellers' choice of individual transport are its reliability, punctuality, quality and availability. Therefore, only close integration of today's fragmented public transport systems will provide a real alternative to the car and create a mobility service at an appropriately high level.

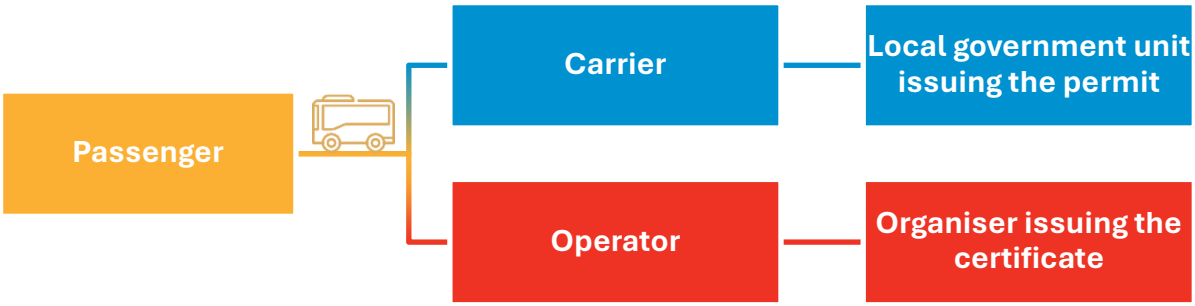


2. INVENTORY OF BUS TRANSPORT IN MW

2.1. ORGANISERS, OPERATORS AND TRANSPORTERS

Organising public transport is an activity that requires cooperation between various entities – both public (e.g. local governments) and private. The legal framework for organising bus transport is set by the PTZ Act, which is currently a key document determining the principles of creating transport connections. The most important bodies necessary to understand the activities of a PTZ include: the Organiser, the operator and the carrier.

Figure 1 . Simplified diagram of the PTZ organisation



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

The task of the **Organiser** is to ensure the functioning of public transport in the managed area. The current number of transport Organisers is not optimal. There are too many of them for each of them to independently perform their tasks, which include:

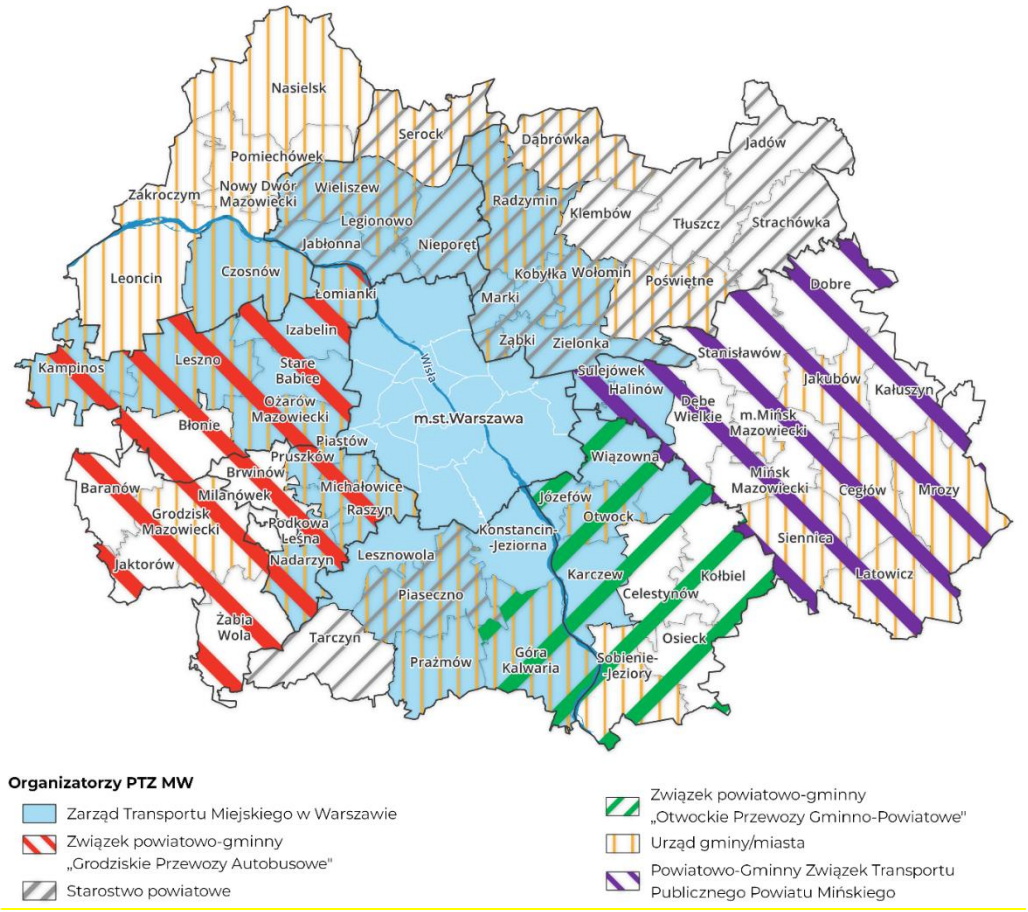
- network planning;
- selecting and supervising transport operators;
- making assumptions about timetables;
- ensuring accessibility to maps and diagrams of communication networks;
- administrating passenger information systems;
- coordinating ticket fares and billing;
- marketing and promotion of public transport;
- ensuring the availability of mobile applications.

Transport management requires cooperation between various local government units and entrepreneurs in order to ensure a coherent and efficient public transport system throughout the metropolitan area. In the current reality, with many entities organising bus transport and an even greater number of operators and carriers, developing an optimal common network for the entire metropolis is a huge challenge. For this reason, the inventory of existing rules for the organisation and implementation of bus transport in the Warsaw Metropolitan Area is a key basis for developing a coherent PTZ network in the future.

As of October 16, 2024, the inventory of Organisers in the Warsaw Metropolitan Area showed:

- **3 district-commune Unions** (Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport], the District-Commune Union "Otwockie Przewozy Gminno-Powiatowe" [Otwock District-Commune Transport] and the District-Commune Union of Public Transport of Mińsk District);
- **4 district-level Organisers** (ZTM in Warsaw and the following districts: Legionowo, Piaseczno and Wołomin);
- **31 commune/city Organisers**.

Map 3. Organisers of bus transport in the Warsaw Metropolitan Area



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Organizatorzy PTZ MW	Organisers of PTZ MW
Zarząd Transportu Miejskiego w Warszawie	Public Transport Board in Warsaw
Związek powiatowo-gminny „Grodziskie Przewozy Autobusowe"	District-commune union "Grodziskie Przewozy Autobusowe" [Grodzisk Bus Transport]
Starostwo powiatowe	District Office
Związek powiatowo-gminny „Otwockie Przewozy Gminno-Powiatowe"	District-commune Union "Otwockie Przewozy Gminno-Powiatowe" [Otwock District-Commune Transport]
Urząd gminy/miasta	Commune/city hall

Powiatowo-Gminny Zawiązek Transportu Publicznego Powiatu Mińskiego	District and Commune Public Transport Union of Mińsk District

It is worth noting that in the areas of some local government units, bus lines are operated by more than one Organiser[4], and in the case of one of the communes, the connections are organised by an entity outside the Commune of MW[5]. Unfortunately, most often the transport services provided by different operators do not have a common ticket tariff and their routes and timetables do not necessarily form a common, coherent whole. Ultimately, such an organisation will make it difficult for passengers to travel, especially those who are forced to use connections organised by different entities.

It should be remembered that in the development of PTZ in the MW area, individual entities can be significantly supported by the **Bus Connection Development Fund**, which serves to financially support local governments launching or maintaining bus connections. Within the MW area there are 21 local governments and 2 district-commune Unions (ZPGOPGP, GPA) which are beneficiaries of subsidies from the programme.

Map 4. MW local government units using FRPA in 2024

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Fundusz Rozwoju Przewozów Autobusowych	Bus Transport Development Fund
Beneficjenci Funduszu w 2024 roku	Beneficiaries of the Fund in 2024

[4]For example, in the city of Legionowo there are lines operated by the City Hall, ZTM, Legionowo District, Serock Commune and Wieliszew Commune.
[5]Line No. 1 (ZKM Sochaczew) runs to the Kampinos commune based on an inter-communal agreement.

Beneficjentami są jednocześnie dwa związki powiatowo-gminne: - Grodziskie Przewozy Autobusowe - Otwockie Przewozy Gminno-Powiatowe	The beneficiaries are two district-commune Unions: - Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport] - Otwockie Przewozy Gminno-Powiatowe [Otwock District-Commune Transport]

The following local government units may benefit from funding under the FRPA: communes, districts, voivodeships and distict-commune Unions that launch bus connections within their territory. The funds are used to subsidize vehicle kilometers and support carriers operating connections on behalf of the Organiser. Importantly, FRPA does not support commercial connections or the independent organisation of public transport. Although the aim of the fund was to improve the public transport offer, its implementation contributed to certain activities that did not have a positive impact on the development of PTZ. This includes subsidising school transport, which is "opened" to other passengers – in this way the real offer does not change. Additionally, the possibility of obtaining central funding contributed to the disintegration of existing networks in selected local government units in Poland. Such a case took place in the Grudziądz Urban Functional Area, where the Communes neighboring the core of the MOF withdrew from the offer of MZK Sp. z o.o. in Grudziądz in favor of cooperation with the distict and the organisation of a separate network[6]. It is worth mentioning, however, that in this case, holders of MZK season tickets can travel on district buses within the city limits on one ticket - however, the acceptance of tickets does not work the other way round.

Within one bus transport network, several **operators** may provide their services. In the case of the largest organisers in the Warsaw Metropolitan Area, i.e. ZTM, GPA, ZPGOPG and PGZTPPM, in the further parts of the study an abbreviation is used referring to the operators of bus networks commissioned by the above-mentioned entities:

- **ZTM bus operators**: Commune Bus Company Sp. z o.o. in Warsaw, MOBILIS Sp. z o.o., Car Transport Company in Grodzisk Mazowiecki Sp. z o.o., Łomianki Commune Transport Sp. z o.o., RELOBUS Transport Polska Sp. z o.o.;
- **GPA operators**: Automotive Transport Company in Grodzisk Mazowiecki Sp. z o.o., PKS Tarnobrzeg Sp. z o.o., PKS Bodzentyn Sp. z o.o.;
- **Operators of the ZPGOPGP**: Janusz Wołoszka – Transport Services, Wołoszka Sp. z o.o.;
- **PGZTPPM[7] operators** : MESIO Transport Services Dariusz Gańko;

The PTZ operator does not always have to be a private enterprise. Selected local government units in the Warsaw Metropolis commission transport services to their own entities - either fully (e.g. in the city of Mińsk Mazowiecki) or partially (e.g. in the ZTM network). It should be noted that a given operator may perform this function within the networks of several different Organisers, and also act as a commercial carrier. Examples of such entities can also be found in selected Communes of the Warsaw Metropolitan Area (e.g. the UTJ Wołoszka company, which is the operator of the ZPGOPGP network,

[6] https://www.powiatgrudziadzki.pl/503,transport-publiczny?content=11443 (accessed 21.10.2024).
[7] As of September 30, 2024

the Sobienie-Jeziory commune line and provides commercial transport services in, among others, the Otwock district).

The list of Organisers, operators and carriers operating
in the Warsaw Metropolitan Area can be found in the sheets
"Organisers, operators" and "Carriers" in the file:
Appendix No. 1 - database

The attachment also includes a list of the **carriers** operating commercial scheduled services within the MW local government units, prepared on the basis of permits issued by the relevant local government bodies (communes, districts, voivodeships). The lines operated by these entities supplement regular bus connections, although the fact is that sometimes they are the only form of public transport in selected areas – especially in the smallest rural villages. According to data as of October 16, 2024, 80 bus carriers were diagnosed in the MW area.

2.2. BUS LINES

The principles of planning the route of lines in the Warsaw Metropolitan Area vary among individual PTZ Organisers. Some of them (e.g. ZTM or the GPA) plan an assumed number of lines and, if necessary, set up variant courses, e.g. on part of the route as reinforcement of the most heavily loaded section (e.g. ZTM line 411) or serving selected additional stops (e.g. ZTM line 198). In turn, other Organisers (e.g. the Pomiechówek commune or the Dąbrówka commune) mark each bus route variant (including the division into weekdays and weekends) as a separate line, which sometimes translates into a significant number of them in a relatively small area. The route planning process itself is very complex and is not the subject of this analysis. However, the key aspects taken into account when determining them include: **the transport potential of individual areas, spatial accessibility, infrastructure availability, as well as openly expressed demand for transport.** In the course of further work on creating directions for the development of the bus network and planning specific lines, traffic studies should be of utmost importance. The currently conducted **Warsaw Traffic Study 2024** will cover not only the City of Warsaw, but also other Communes of the metropolis. The results of this type of research, as well as smaller, local or random studies, should be considered as an important source of reliable and authoritative information about the mobility needs of MW residents. Knowledge of the existing needs should therefore be the basis for the future Organiser of metropolitan transport (see chapter 3.) in order to develop an appropriate and optimal transport offer.

A very important (and in some places the most important) condition for creating connections and locating new ends/stops in the metropolis is the need for feeder transport to railway lines from areas not connected by rail. Since **rail transport is the basic backbone of the entire metropolitan transport network**, bus lines that serve as feeders to the railway are among the most important. This arrangement enables convenient and efficient access for residents as part of combined journeys. Similarly, although on a smaller scale, a Warsaw network is being created, which, in addition to transport to railway lines, also provides users with the opportunity to reach the tram network and both metro lines by bus.

The marking of bus lines is directly related to their route. In the MW local government units there are no top-down, metropolitan guidelines that would indicate the numbering principles. Lines organised by ZTM or ZPGOPGP are marked according to an internally determined code. However, it can be assumed that lines in commune networks are usually assigned consecutive numbers (example of the city of Pruszków or Wołomin District) or numbers preceded by a letter (bus lines in the Radzymin or Dąbrówka communes). The lack of standards for the numbering of PTZ lines for the entire metropolis translates into duplicate designations. As an example, there are multiple lines marked as "1". Such transport is organised by several local governments, including: Serock commune, Łomianki city, Nowy Dwór Mazowiecki city, Nasielsk commune, Pomiechówek commune, Zakroczym commune and Wołomin district. In selected MW local government units, there are also lines that do not have any markings at all, apart from indicating their ends, e.g. the “Roztoka – Błonie” line operated by the Leszno

commune. This type of line marking is very common among commercial carriers, e.g. on the Warsaw – Wyszków route.

It is worth noting that the data contained in the certificates and the timetable information available on the organiser's website are not always identical. An example could be line W12 organised by ZPGOPGP, which has different ends in both sources. When analysing the timetable data of individual lines, one can also notice the diversity in their presentation, even within a single Organiser. Sometimes lines are even not included in the timetable. An example is the table with timetables of buses operated by the Prażmów commune (lines numbered 610 to 616), which contains the routes of several lines, but their numbers are not provided.

All the elements described above resulted in a **high level of complexity of the analysis and synthesis of collected data.** In order to simplify the process of merging bus lines within the MW into a common database, a data presentation scheme was developed. In the lists provided in the appendix, the following colour distinction is made between the lines of individual organisers:

- **XX** - Public Transport Authority of Warsaw;
- **XX** - District-Commune Union "Grodziskie Przewozy Autobusowe" [Grodzisk Bus Transport];
- **XX** - District-Commune Public Transport Union of Mińsk District;
- **XX** - District-Community Union "Otwock District-Community Transport";
- **XX** - commune/city office;
- **XX** - district office;
- **XX** - commercial carrier.

Additionally, each line has been supplemented with a detailed set of data, which includes: Organiser, operator, ends (with location by town), approximate route by town, number of journeys (divided into weekdays - DP, Saturdays - SB and Sundays - ND) and possible **variants**. Each variant of a given line differing in its extremes was saved as a separate row in the database. Variants in which the line ends without changes are included only numerically in the appropriate column. It should also be noted that the database was created in the period from August to October 2024, so it may contain outdated information due to dynamic changes in the Warsaw Metropolitan Area, e.g. resulting from renovation works or changes in the Organiser of a given line (example of lines K1 and K2 in the Karczew commune). In the case of the ends that are located outside the Warsaw Metropolitan Area, their location is written in italics (e.g. *Przasnysz D.A.*).

An overview of bus lines operating
in the Warsaw Metropolitan Area can be found in the "Lines" sheet in the file:
Appendix no. 1 - database

The multitude of bus lines, their designations, as well as the Organisers of bus connections themselves, combined with the lack of tariff integration, has an indisputably

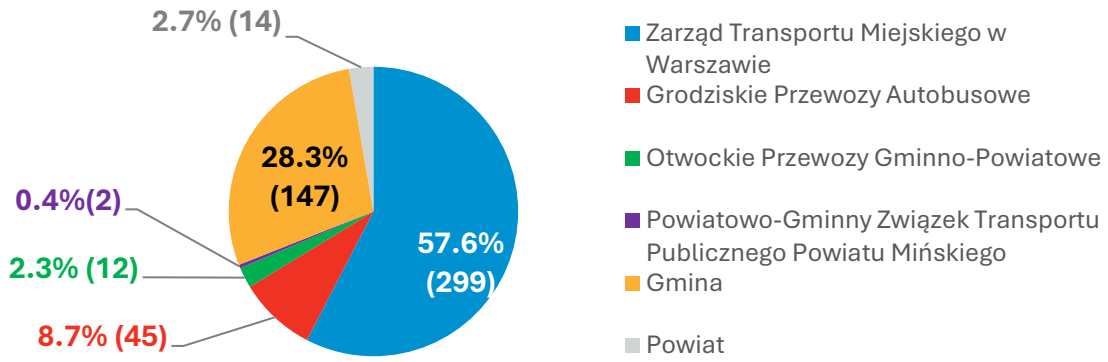
negative impact on the opinion about PTZ. It can therefore be assumed that an average passenger who would like to use the PTZ offer for the first time in an unfamiliar commune would have a problem with planning the route.

The collected data on bus lines showed that as of September 30, 2024, there are **519 bus lines** in the Warsaw Metropolitan Area operated by MW local government units or district-commune Unions.[8] The largest number of them are organised by the capital city's Public Transport Authority. That's 299 lines, 42 of which are night lines. However, lines are also key to the metropolitan scale:

- suburban (35 lines numbered 7xx);
- suburban periodicals (5 lines numbered 8xx);
- local (51 lines numbered Lxx);
- regular and seasonal city buses running outside the City of Warsaw, but covered by ticket zone I (20 lines numbered 1xx, 2xx and 3xx);
- night buses going outside the City of Warsaw (11 lines numbered Nxx).

The second largest entity is the District-Commune Union GPA with 45 lines. Aggregating the type of Organiser, the vast majority of bus lines in the Warsaw Metropolitan Area are launched by local governments – 147 in total. In turn, the districts organise 14 lines, and the district-commune Unions (GPA, ZPGOPGP and PGZTPPM) – 59 in total. Importantly, the number of lines will certainly increase, as indicated by, among others, plans for the development of the connection network of the District-Commune Public Transport Union of Mińsk District.

Graph1. Bus lines in the Warsaw Metropolitan Area according to the Organisers



Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on data from local government units.

PL	EN
Zarząd Transportu Miejskiego w Warszawie	Public Transport Authority in Warsaw
Grodziskie Przewozy Autobusowe	Grodzisk Bus Transport
Otwockie przewozy Gminno-Powiatowe	Otwock commune-district transport
Powiatowo-Gminny Związek Transportu Publicznego Powiatu Mińskiego	District-Commune Union of Public Transport of Mińsk District
Gmina	Commune

[8]The analysis did not take into account school lines and lines operating during selected periods of the year (e.g. cemetery lines), tourist lines and others operating only occasionally.

Powiat	District

Although the largest Organiser of PTZ in MW is the Warsaw ZTM, most of the lines it runs only within the City of Warsaw. **However, the number of ZTM lines of metropolitan importance is significant and amounts to 143.**The fact that almost half of the lines operated by this entity connect the capital with neighbouring communes indicates very strong ties within the metropolis and a great need to implement the PTZ network jointly, and not separately, for each commune.

Map 5. Bus connections in the Warsaw Metropolitan Area organised by the MW local government units and district-commune Unions

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Samorząd powiatu	District government
Samorząd gminy	Commune self-government

In terms of cooperation, certain activities aimed at creating a coherent and logical network are already visible. An excellent example of this is the southwestern part of the metropolis, where the Warsaw ZTM lines complement the GPA lines. In general, **the network on the western side of MW is already quite dense**, although there are some

exceptions. The most important one is the Tarczyn commune, in relation to which the term transport exclusion can be used.

The situation is slightly different in **the eastern part of the metropolis, where a much larger area does not have access to connections organised by public entities.** The communes of Dobre and Kałuszyn are completely excluded from them, and many have a network of connections with a very low density (Jadów, Strachówka, Tłuszcz, Stanisławów, Dębe Wielkie, Zielonka, Halinów, Mińsk Mazowiecki, Mrozy, Celestynów, Osieck). It can be assumed that, to some extent, this difference between the East and the West is due to differences in building density and population size. However, other reasons may also include organisational, managerial or financial problems, as well as the issue of inter-unit cooperation skills.

The inventory of the metropolitan line network revealed a significant problem related to the method of planning connections, probably resulting from legal conditions, but also from the issue of cooperation skills of individual local government units. In general, it can be concluded that the organisation of PTZs by local governments turns out to be of little benefit from the point of view of network coherence (and thus benefits for passengers) on a metropolitan scale. Commune networks very visibly serve a given area only up to the borders of the commune, in rare cases enabling passengers to travel between Communes. This situation occurs primarily in the eastern communes of the metropolis and in the commune of Nasielsk. The existence of such "invisible" barriers in the form of local government boundaries sometimes even forces **the creation of "blind" communication lines with illogical routes**, examples of which can be multiplied. A much better solution in this context is to use district-commune Unions or organise PTZ in cooperation with the Warsaw ZTM.

Commercial connections complement the local government transport offer. According to the permit lists received from the MW local government unit and the Masovian Voivodeship Marshal's Office, there are **217** such connections and they are operated by **80 bus carriers.** The database collected as part of the analysis also includes carriers that were issued permits to use ZTM stops in the City of Warsaw. Analyses of bus route connections have shown that the carriers' offer is most extensive in 6 directions departing from the City of Warsaw:

- Radzymin, Wołomin, *Wyszków*;
- Serock, *Pułtusk*;
- Nowy Dwór Mazowiecki, Zakroczym;
- Góra Kalwaria, *Kozienice*;
- Tarczyn, *Grójec*;
- Mińsk Mazowiecki, *Siedlce*.

Commercial carriers' network connections are much more consistent over larger areas than public transport. They connect separate local government units much better, allowing passengers to move more freely on a metropolitan scale than local government

Organisers are able to offer. Moreover, commercial lines also provide connections outside the MW, which is a very important element, practically not taken into account in the network organised by local government units. **The commercial network is therefore an important system that connects the metropolis with neighboring areas**, which should be taken into account in the development of the entire organism.

No area should function in isolation from its neighbourhood. However, an important element should be noted - a separate ticket tariff and line management affects the separation of commercial connections from those organised by local government entities. Private carriers' lines should therefore be considered in the context of complementing the offer of the local government PTZ in supra-local or even supra-metropolitan connections rather than its substitute, which is visible in the case of selected MW communes.

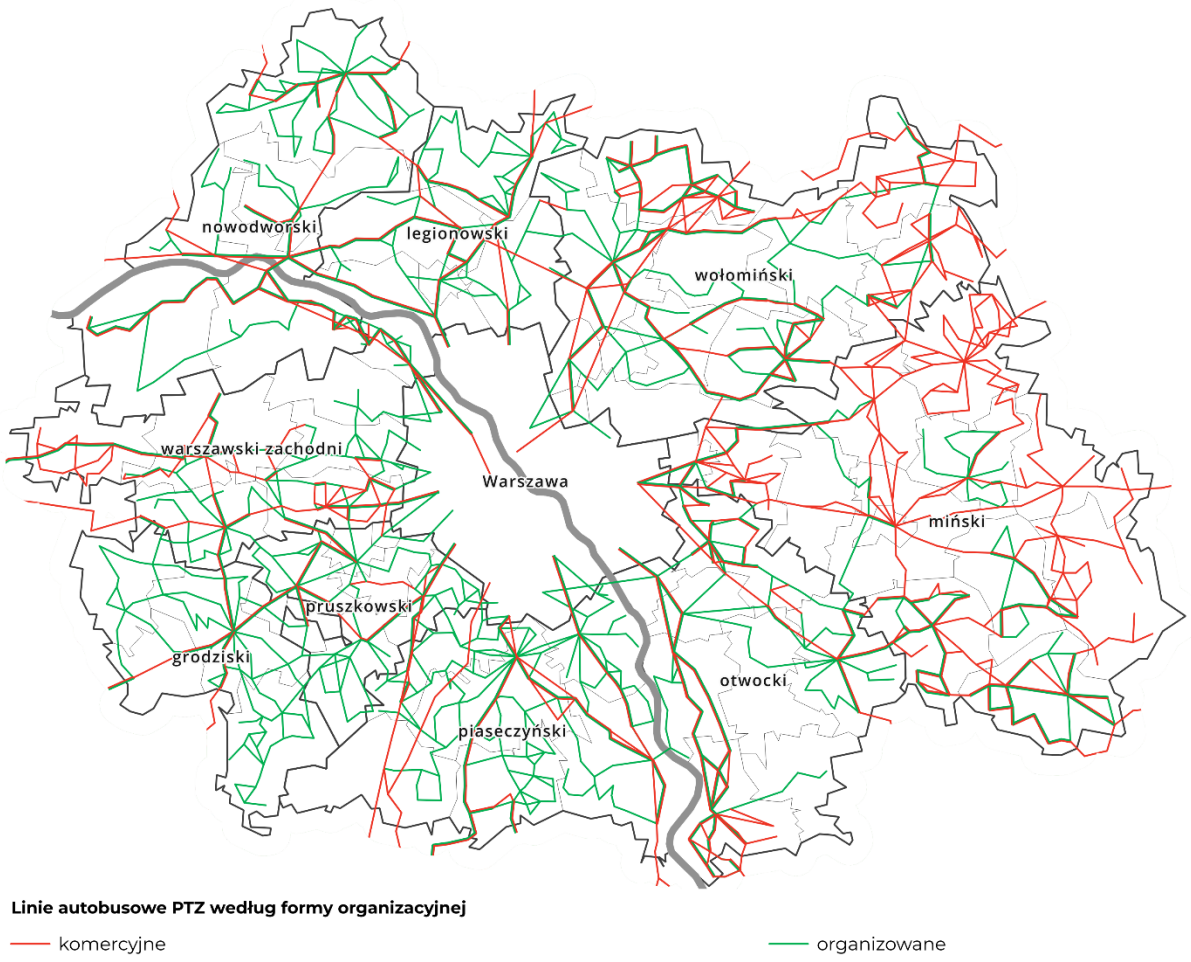
Map 6. Commercial bus connections in the Warsaw Metropolitan Area

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Siatka linii autobusowych o charakterze komercyjnym	Commercial bus line network
Przebieg linii	Line route
Główne kierunki docelowe linii wychodzących poza obszar MW	Main destinations of lines going beyond the MW area

Although both of the analysed bus networks (local government and commercial) have their drawbacks in terms of the communication system, it must be admitted that as a whole they already form **a fairly dense and evenly planned system.** It is very visible that commercial carriers largely complement the network where the local government does not provide public transport to residents. This is best illustrated in the eastern part of the metropolis. An interesting case is the Dobre commune, which does not organise its own PTZ, but has a fairly dense network of commercial connections. Looking at the entire connected system, one can notice that virtually the entire MW area is covered by a more or less dense bus transport network. However, there are still places where access to it is minimal. They should exclude areas covered with forests (Kampino National Park and Masovian Landscape Park), which primarily include the Tarczyn commune and individual areas in Mińsk and Wołomin districts.

Map 7. Bus connections in the Warsaw Metropolitan Area



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

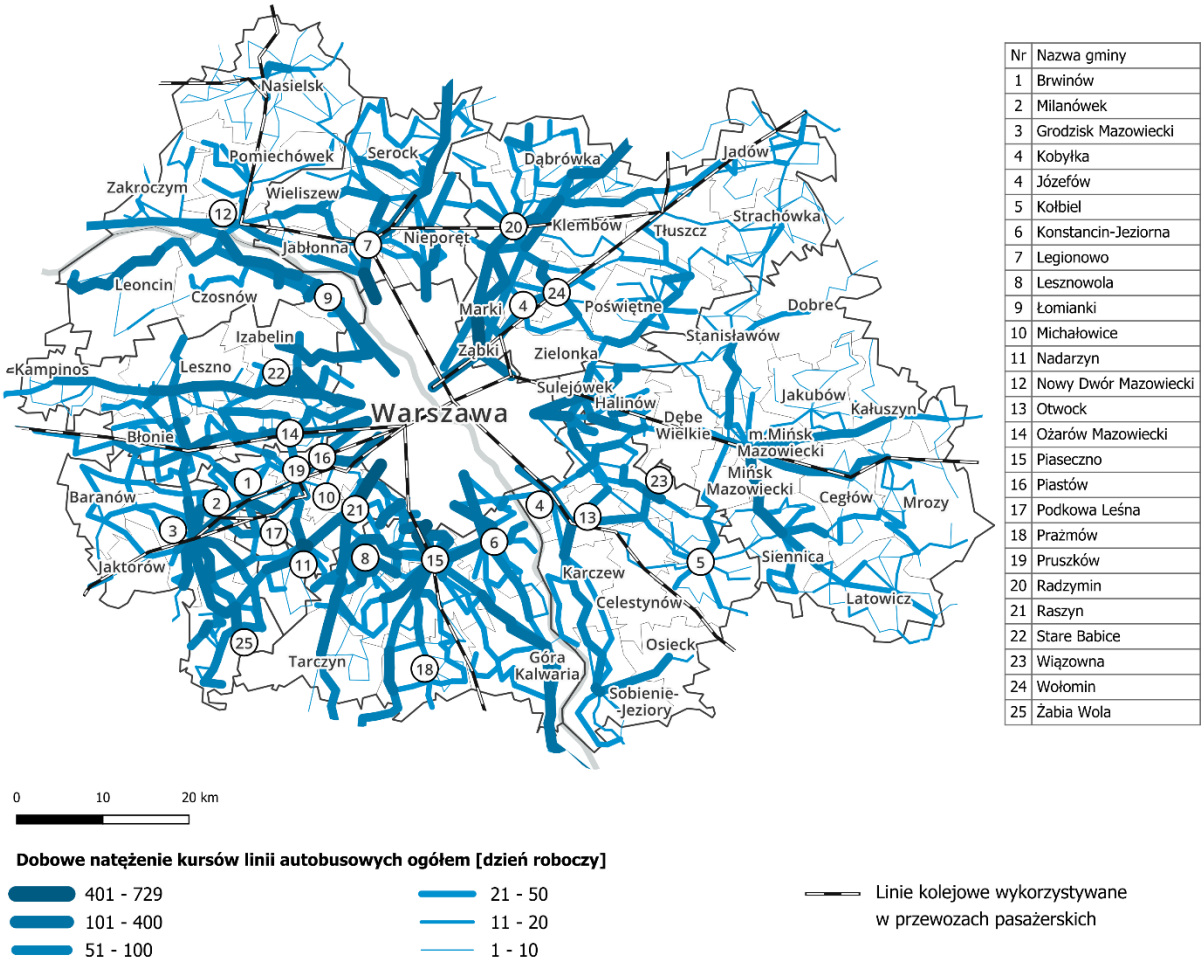
PL	EN
Linie autobusowe PTZ według formy organizacyjnej	PTZ bus lines by organisational form
komercyjne	commercial
organizowane	organised

It is worth noting that there are also other bus lines running through the Warsaw Metropolitan Area, not included in the list, such as the FLIXBUS carrier, which perform a transport function in a broader context than metropolitan transport. Additionally, a significant portion of the permits accepted by the local government units date back several years, and one was issued for an indefinite period in 2001. The validity of some of them is therefore questionable. Adding to this the lack of information on the Internet or travel planners, it is difficult to determine whether information about a given line is current outside the location of the route.

However, the sheer number of bus routes in operation is not indicative of the quality of the PTZ network. Key issues include: the number of journeys, access to transport infrastructure, connection and coordination with other means of transport, and travel times to destinations. Other important determinants of quality are such elements as: access to information and its quality, the structure of ticket tariffs and ticket prices, as well as the quality of rolling stock and its capacity, cleanliness and equipment, as well as punctuality and reliability of services. However, the level of these elements varies greatly across the metropolis. On the scale of the entire area, accessibility can be mentioned in general. As shown in the earlier part of the chapter, the level of coverage of the MW area with bus lines is quite high, therefore the accessibility to the network is also relatively high. Unfortunately, due to limited access to information it was not possible to present it in detail at this time. However, the factor that significantly determines the availability of PTZ is the daily number of courses (Map 8). This, like the network density, is highest in the southwestern part of the metropolis. The largest number of bus journeys was also identified along the main road communication routes leading out of Warsaw, i.e. routes S7 (in the north), S8 (in the north), DK61, as well as on the initial section towards the east, along DK92. Once again, there is a significant discrepancy between the eastern and western parts of the MW. In the latter, there are many towns which are reached by buses rarely, very rarely or not at all.

The inventory also showed how important a complementary function the bus network plays in relation to the rail network. In Map 8 it is very clearly visible that the main transport corridors, radiating from the core of the metropolis, used by bus lines, do not duplicate railway lines but rather densify them. First of all, these are routes along the above-mentioned national roads and expressways: S7 (in the north and south) and S8 (in the north and south), but also along the DK7, DK79 and DW580. The feeder function of buses is also clearly visible, especially in the GPA network area and in the broadly understood surroundings of communes such as Mińsk Mazowiecki, Piaseczno and Błonie. Again, the northeastern part of the metropolis has the lowest level of service, also due to the lack of a railway line.

Map 8. Daily number of bus routes on a working day in the MW area



Nr	Nazwa gminy
1	Brwinów
2	Milanówek
3	Grodzisk Mazowiecki
4	Kobyłka
4	Józefów
5	Kołbiel
6	Konstancin-Jeziorna
7	Legionowo
8	Lesznowola
9	Łomianki
10	Michałowice
11	Nadarzyn
12	Nowy Dwór Mazowiecki
13	Otwock
14	Ożarów Mazowiecki
15	Piaseczno
16	Piastów
17	Podkowa Leśna
18	Prażmów
19	Pruszków
20	Radzymin
21	Raszyn
22	Stare Babice
23	Wiązowna
24	Wołomin
25	Żabia Wola

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

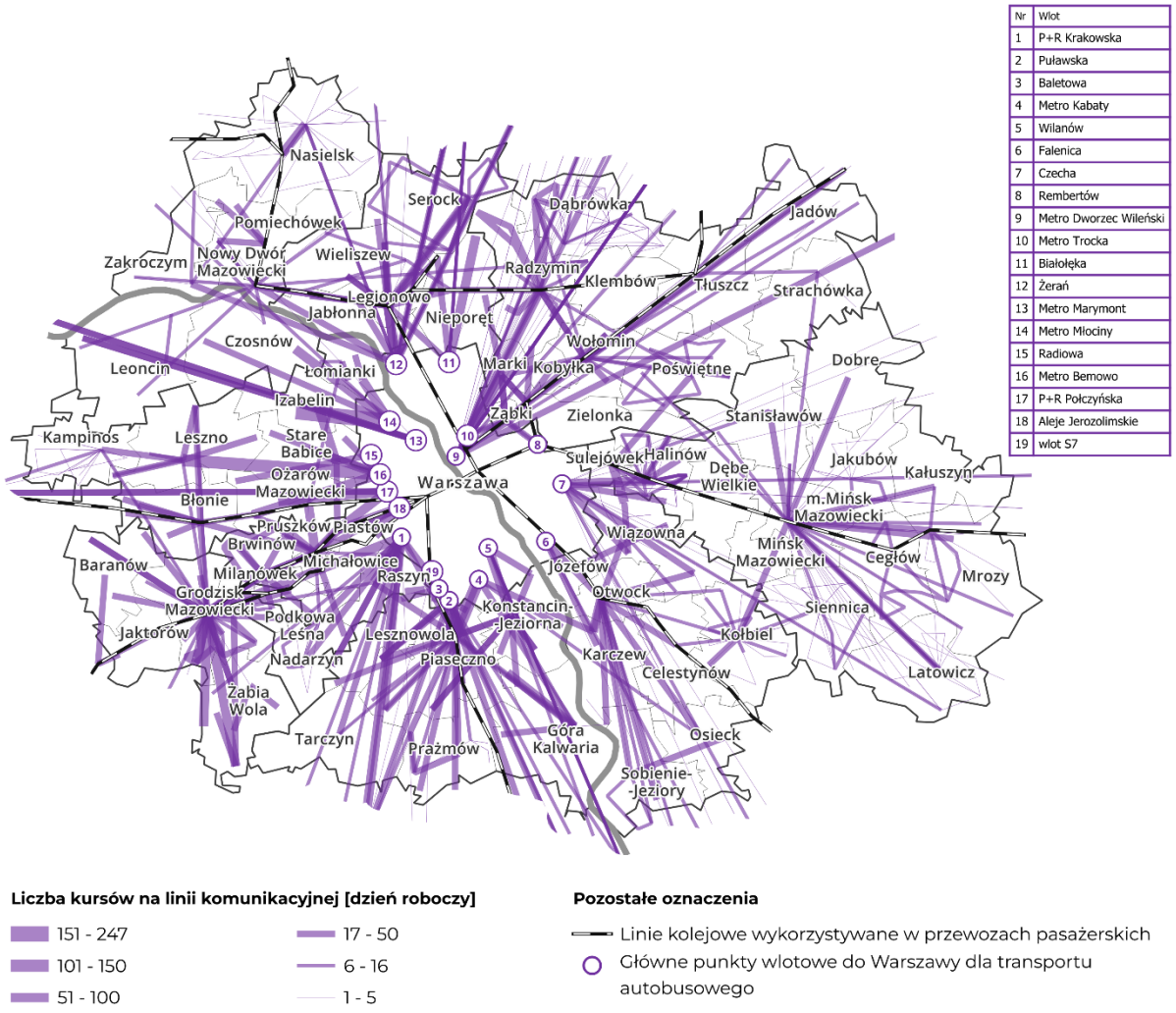
PL	EN
Nr.	No.
Nazwa gminy	Name of the commune
Dobowe natężenie kursów linii autobusowych ogółem [dzień roboczy]	Daily intensity of bus routes in total [working day]
Linie kolejowe wykorzystywane w przewozach pasażerskich	Railway lines used for passenger transport

A detailed version of the above map, containing numerical values presenting traffic intensity on individual sections, and other maps showing the number of journeys by individual types of days and types of transport prepared in A3 format can be found in the file:

Appendix no. 2 – detailed maps

By collecting very detailed data, presented on maps, and aggregating them appropriately, a diagram of bus traffic in the entire metropolis was obtained. Naturally, **most connections are made on weekdays** when the demand for transport is the highest. The truss system is distributed radially from Warsaw with additional key local centers in Grodzisk Mazowiecki, Piaseczno, Otwock, Nowy Dwór Mazowiecki, Konstancin-Jeziorna, Radzymin and Mińsk Mazowiecki, although the first two of them have a network with by far the highest bus frequency in their area.

Map 9. The intensity of the number of bus journeys on a working day between the ends of the communication lines in the Warsaw Metropolitan Area

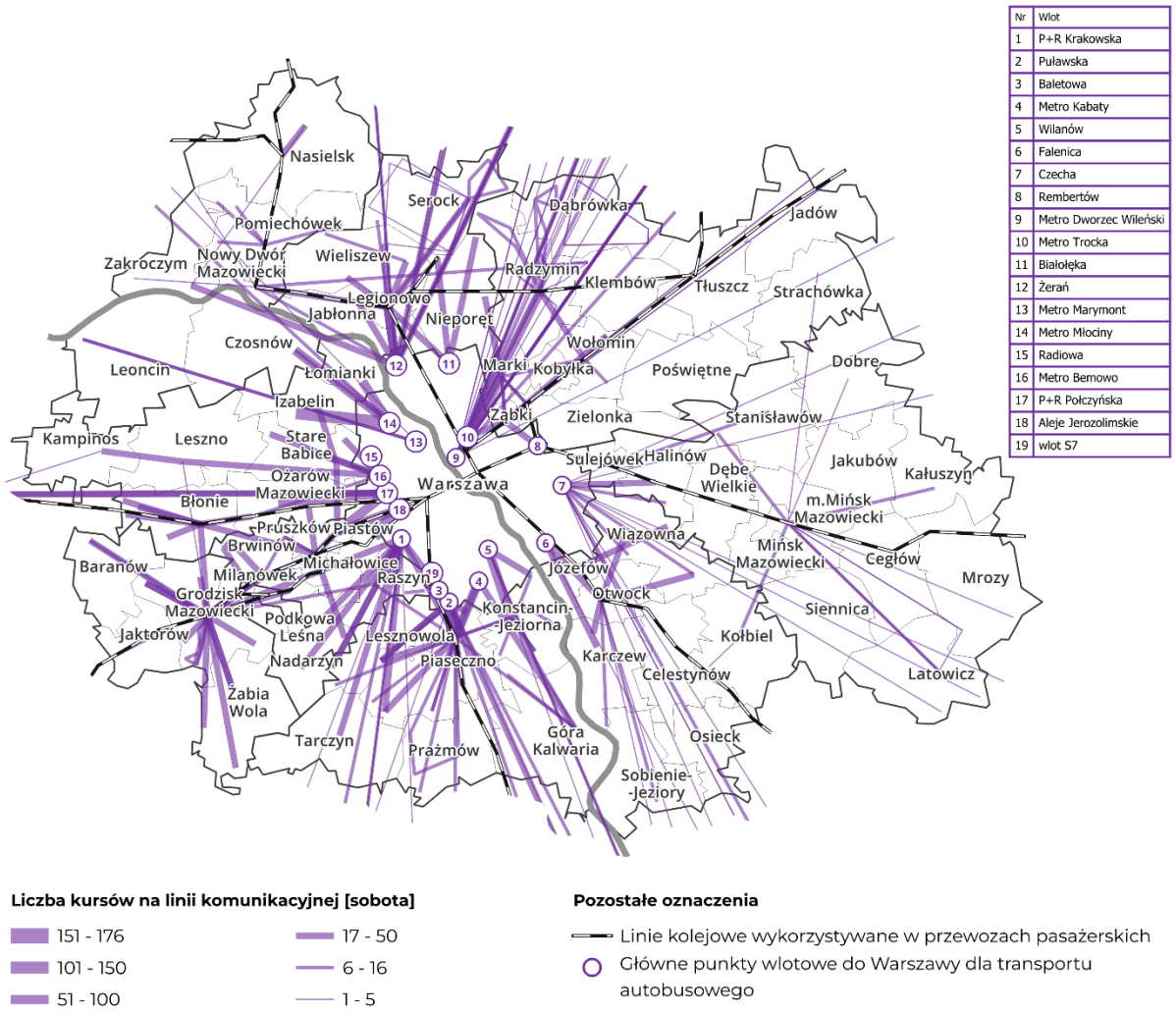


Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Nr.	No.
Wlot	Entry
Liczba kursów na linii komunikacyjnej [dzień roboczy]	Number of journeys on the transport line [working day]
Pozostałe oznaczenia	Other designations
Linie kolejowe wykorzystywane w przewozach pasażerskich	Railway lines used for passenger transport
Główne punkty wlotowe do Warszawy dla transportu autobusowego	Main entry points to Warsaw for bus transport

There are generally fewer courses offered on non-working days than on working days. There is no significant difference in their number between Saturday and Sunday, but there are some connections that are not serviced at all on Sundays. Again, this is particularly visible in the eastern part of the analysed area, as are the "invisible" barriers in the form of borders – in this case mainly of districts.

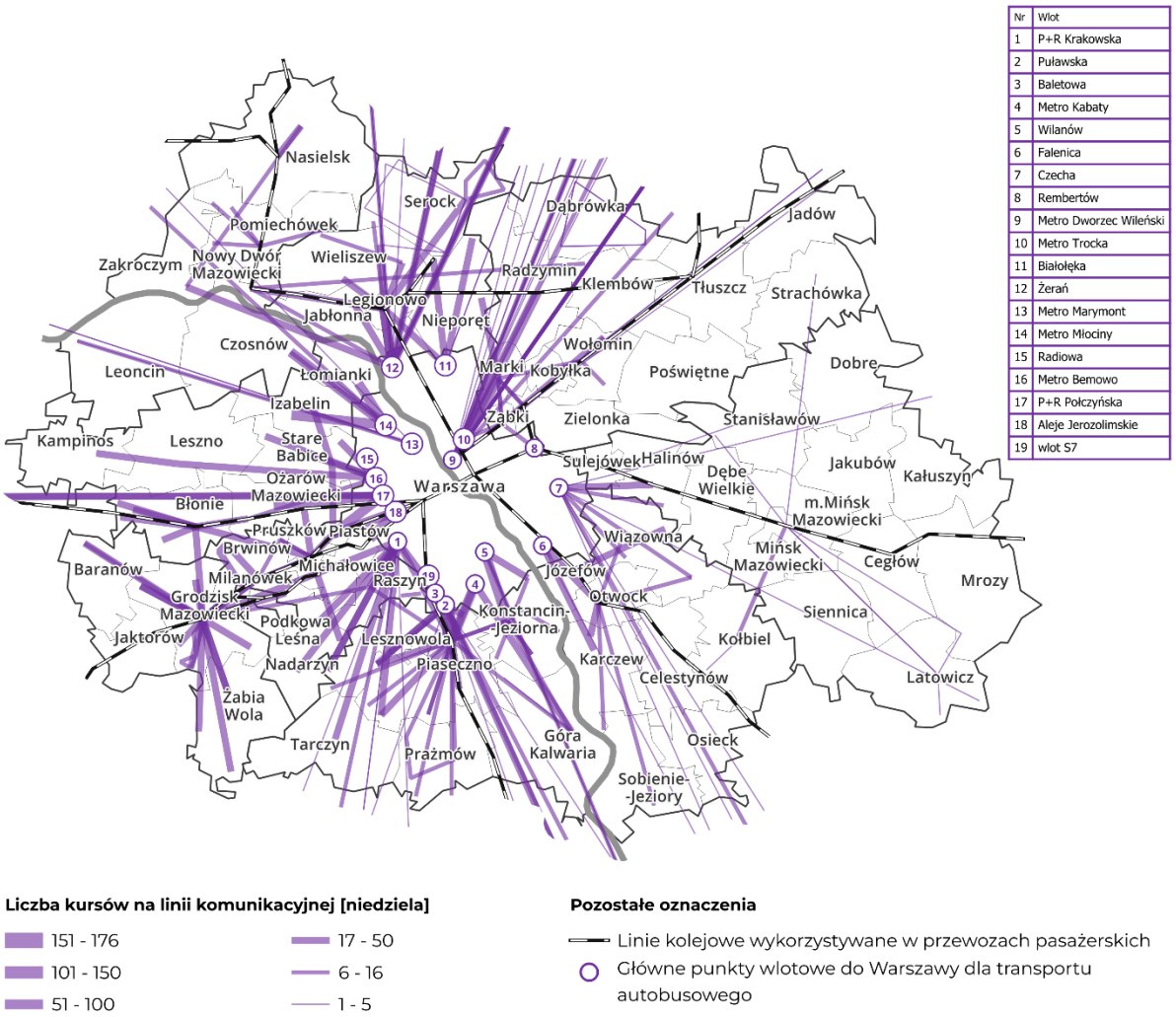
Map 10. The intensity of the number of bus journeys on weekends between the ends of the communication lines in the Warsaw Metropolitan Area



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Nr.	No.
Wlot	Entry
Liczba kursów na linii komunikacyjnej [sobota]	Number of journeys on the transport line [Saturday]
Pozostałe oznaczenia	Other designations
Linie kolejowe wykorzystywane w przewozach pasażerskich	Railway lines used for passenger transport
Główne punkty wlotowe do Warszawy dla transportu autobusowego	Main entry points to Warsaw for bus transport

Map 11. The intensity of the number of bus journeys on Sunday between the ends of the communication lines in the Warsaw Metropolitan Area



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

PL	EN
Nr.	No.
Wlot	Entry
Liczba kursów na linii komunikacyjnej [niedziela]	Number of journeys on the transport line [Sunday]
Pozostałe oznaczenia	Other designations
Linie kolejowe wykorzystywane w przewozach pasażerskich	Railway lines used for passenger transport
Główne punkty wlotowe do Warszawy dla transportu autobusowego	Main entry points to Warsaw for bus transport

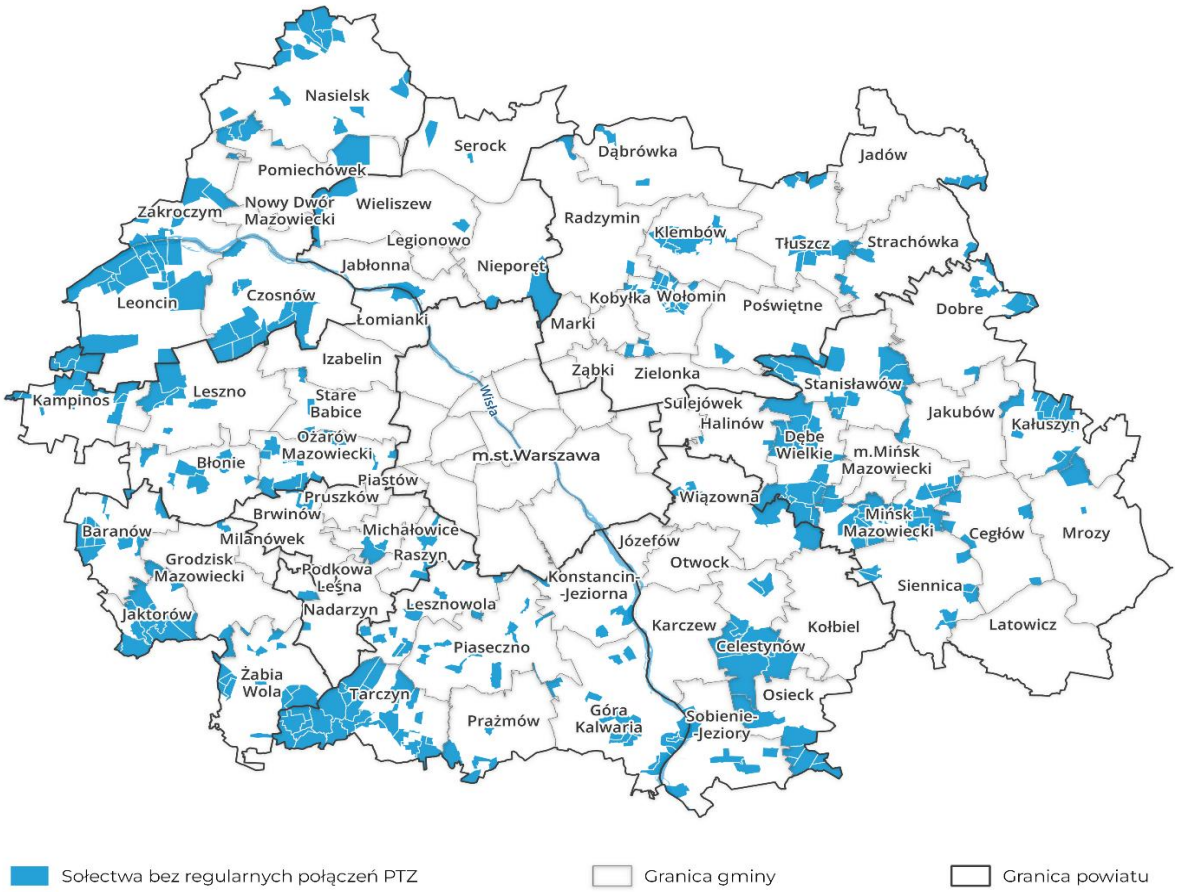
Detailed maps illustrating the traffic intensity by day type and type of transport, prepared in A3 format, can be found in the file:

Appendix no. 2 – detailed maps

The fact that the system of public and private lines (as well as railway lines) largely complements each other means that in total the user receives a much denser network of

connections. The high frequency of many of them also determines the availability of the entire system. Thanks to this, ultimately there are significantly fewer **areas of transport exclusion** (so-called "white spots") in the analysed area. Unfortunately, such still exist, for example on the border of the Tarczyn and Żabia Wola communes, in the south of the Osieck commune and the north-west of the Leoncin commune, but also in other areas. These are areas where special attention should be paid to the development of PTZ. In the metropolis, apart from typical forest areas, there are also exclusion areas, which, however, are regions with low or very low development intensity, such as a large part of the Communes of Celestynów, Czosnów, Jaktorów. These are areas where the level of building density and therefore the demand for transport (current and forecast) should be monitored on an ongoing basis in order to respond to possible changes or to consider implementing alternative forms of public transport (e.g. so-called "buses on demand" or opening school lines).

Map 12. Areas of transport exclusion in MW



Source: Own study by the Team of Economic Advisors TOR Sp. z o.o.

PL	EN
Sołectwa bez regularnych połączeń PTZ	Villages without regular PTZ connections
Granica gminy	Commune border
Granica powiatu	District border

On the subject of the lack or insufficient number of connections, it is also worth mentioning the communes that are members of the District-Commune Public Transport

Union of Mińsk District. They provided information about the transfer of transport organisation in their area to the aforementioned Union. However, due to problems not identified by the Contractor, the plan to launch PGZTPPM connections on September 1, 2024 was not implemented, and as of the end of October, the union only organises two bus lines (P1 and P2).[9] The need to implement connections in this area is clearly visible – the villages neighbouring the city of Mińsk Mazowiecki constitute one of the largest concentrations of transport exclusion areas.

2.3. TECHNICAL FACILITIES

Technical facilities (also: bus depots or bases) are key elements of infrastructure used by operators/carriers to efficiently manage their vehicle rolling stock. They are places where buses (and sometimes also service/technical vehicles) are garaged, serviced, refueled and prepared for daily use. Depending on the depot, they are equipped with mechanical workshops, diagnostic stations, spare parts warehouses, car washes and fuel stations. The effective functioning of the technical facilities is necessary to ensure safety, reliability and punctuality of transport, which is crucial for the provision of transport services. In turn, the proper geographical location of the base may have a significant impact on the costs of transport operations.

Among the operators and carriers providing bus services within the Communes and districts of the Warsaw Metropolitan Area, there are companies that do not have their own bases. In such cases, the vehicles are garaged on the premises (e.g. drivers, owners of transport companies or on rented parking lots), and their service and ongoing maintenance is carried out by external entities providing such services.

An issue worth addressing is the **legal requirements regarding social facilities.** One of the national legal acts addressing this topic is the Regulation of the Minister of Infrastructure of December 16, 2021 on occupational health and safety in public transport and intercity bus transport. Chapter 9 of this legal act deals with, among other things, the minimum requirements for an operator or carrier, which relate to:

- providing access to a toilet and a social room;
- location and equipment of social rooms;
- equiping public transport vehicle cabins (e.g. separate air conditioning or heating).

Importantly, in the aforementioned regulation, in Chapter 10, the deadlines for adapting social facilities to the requirements were indicated, i.e. *"within 36 months from the date of entry into force of the regulation, dining rooms and sanitary facilities located at the ends of communication lines should be adapted to the requirements (...)"*. This means that by April 19, 2025, operators and carriers should meet the legal requirements. Potentially, the change in regulations may translate into an increase in the costs incurred by local government units to finance public transport.

[9]Launched September 23, 2024

There are 39 bus depots within the Warsaw Metropolitan Area. Buses operating on routes organised by entities from the Navy are also stationed at bases located outside its borders. However, there is no detailed information about their location.

Map 13. Technical support of bus operators and carriers in the Warsaw Metropolitan Area

Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on local government data.

PL	EN
Obszary Metropolii Warszawskiej	Warsaw Metropolitan Areas
Centralny	Central
Bazowy	Base
Kluczowy	Key
Rozwojowy	Developmental
Pozostały	Other
Ośrodek lokalny	Local center
Zajezdnie/bazy operatorów I przewoźników	Operator and carrier depots/bases
Granice gmin	Commune boundaries
Granice powiatów	District boundaries

The list of identified technical facilities in the Warsaw Metropolitan Area can be found in the "Base and depots" sheet in the file:

Appendix No. 1 - database

2.4. ENDS, TERMINALS AND BUS STATIONS

Termini, terminuses and stations play an important role in bus route planning, fulfilling several significant functions. First of all, they allow for a stop between subsequent journeys at a designated place outside the regular traffic. Additionally, the location of the line's end points is linked to the surrounding important transfer points or traffic generators. **A total of 589 stops acting as termini were identified** within the MW area. Additionally, lines running within the metropolis have 61 terminus outside its borders.

In many places, not only the Warsaw Metropolis, it can be noticed that the planning of bus routes is not always carried out taking into account the marginal infrastructure for public transport vehicles. In the areas of a significant number of local governments, buses stop in bus bays, and any possible turning manoeuvre to carry out the return trip is carried out using existing road infrastructure (e.g. roundabouts). If it is not possible to change direction, the line usually operates a one-way route via the nearest streets in order to return to the route. Although in principle this is not an inappropriate organisation (it usually results from the desire to provide passengers with transport despite infrastructure deficiencies), it is worth striving to ensure that ensuring the accessibility of infrastructure (and land for infrastructure) is obligatory, e.g. through properly constructed provisions of MPZP, SUiKZP or General Plans.

An important addition to the terminals are **social facilities**, i.e. places adapted for bus drivers and sometimes also other service staff. These facilities may take different forms and have different functions, but their primary purpose is to provide rest and sanitary facilities for drivers.

The outskirts of a metropolis differ not only in the area of space available for vehicles, but also in the infrastructure and arrangement of the surroundings. The analysed area includes both transfer hubs enabling a change of means of transport with multi-storey car parks, passenger waiting rooms, bicycle shelters, public bike stations and electric vehicle charging infrastructure, as well as bus stops without a hardened stop edge only with the D-15 sign (bus stop). It is worth mentioning that the nodes included in the list in Appendix no. 1 are not the only nodes in the metropolis. The "Terminals, loops" sheet contains only those nodes and stops that are used as the final stops of at least one bus line. The remaining ones, not included in the list, are transit stops on the routes of selected lines and do not currently function as loops/terminals. An example of such a junction could be the Legionowo Piaski PKP stop.

A significant problem in terms of ends, loops and stations, although this also applies to intermediate/through stops, is their inconsistent **nomenclature.** In the PTZ MW network there are stops that have different names depending on the perspective of the operator/carrier we are looking at them from. For example, the end of "PKP Halinów", according to the Warsaw ZTM, is called "Hipolitów pętla" by the ABUS carrier. Ends can have a total of two, three, four or even five alternative names, e.g. the loop referred to by ZTM in Warsaw as "PKP Wołomin" is also called "PKP 01", "PKP Legionów corner of Żelazna", "Wołomin PKP ul. Legionów róg Żelaznej" and "Wołomin P.K.P.". Even stops have been identified which in the timetables are simply given a sequential number according to the route covered, without providing a name. This may lead to a situation in

which the same stop will not only have different names, but also be marked with a different number, depending on which line the passenger will travel. Such naming inconsistency can be very inconvenient for passengers (current and potential) and may lead to discouragement from using PTZ services or mislead users, complicating the entire travel process.

In the PTZ network, one can also observe termini (and stops) that are inconvenient or even burdensome from the passenger's point of view. These may be, for example, too extensive junctions, forcing the user to cover too large distances when changing trains (e.g. the Metro Młociny junction or the Płowiecka stop) or important transfer junctions where some lines, even those of the same operator, do not stop (e.g. the aforementioned Płowiecka junction, which, when travelling in one direction, bypasses some lines due to the specific road layout – lines travelling from ul. Ostrobramska and Trasa Siekierkowska further on ul. Płowiecka i.e. 411, 502, 521 i 525). There are also ends which are in fact located in two or even three different locations, significantly separated from each other, e.g. the ends of CH Marki, Konwiktorska, Stara Miłosna (Ułańska), Natolin Płn. Termini/stops were also identified whose level of complexity of operation may also mislead passengers. These are primarily stops/terminals at, for example, newly constructed tunnels under railway lines. To ensure their proper geometry, complex road systems are created in such places, e.g. the terminus of PKP Międzylesie line 305.

Although many inconsistencies have been identified in the system of naming and organising termini (and stops) in the MW area, it can be assumed that their unification and thus adaptation to the integrated network on a metropolitan scale is not impossible, and should not even constitute a significant problem. The key issue here will be to develop appropriate standards and adopt them by individual entities that will operate together in the analysed area in the future. The fact is, however, that the issue of ensuring this consistency in naming and organisation will be a very important element of integration and ensuring its functionality and transparency.

A list of the extremities used by the bus lines running
in the area of the Warsaw Metropolitan Area can be found in the sheet "Terminals, Loops" in the file:
Appendix no. 1 - database

2.5. THE ROLLING STOCK

Coordination and management of bus routes, provision of technical support, arrangement of ends and loops are very important elements of PTZ organisation. However, it would not exist without the rolling stock. Vehicles serving bus lines differ in length, type of drive, and passenger information system. Depending on the Organiser, the availability of vehicles and the size of the transport needs on a given route, the rolling stock available for the routes may differ within one communication line. The bus rolling stock can be divided according to its length, and there are 4 **classes of buses**:

- MINI – a bus up to 8.99 m long;
- MIDI – a bus whose length is from 9 to 10.99 m;
- MAXI – a bus whose length is from 11 to 13 m;
- MEGA – a bus whose length is from 13 to 16 m (MEGA15) or from 16 to 18.75 m (MEGA18).

Map 14. Status of information on rolling stock used in commissioned transports in MW

Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on local government data

PL	EN
Organizatorzy PTZ nieposiadający informacji o taborze w zlecanych przewozach	PTZ organisers who do not have information about the rolling stock in the ordered transports
gminy	Communes
powiaty	districts

Unfortunately, **the data held by local government units often do not contain information on the rolling stock used in PTZ connections**, or the only information is the number of vehicles serving the organised lines. There is no information on the size of the vehicles, their equipment and condition. In general, the rolling stock data provided for the purposes of this analysis had a very varied level of detail – from a detailed list of the rolling stock owned, specifying the model, type or drive, through a division of the rolling stock according to the number of seats, to a complete lack of any mentioned data, e.g. with reference to a business secret. Despite difficulties with access to data, it was estimated that no gas-powered vehicles (CNG/LNG) are used in transport outside the City of Warsaw, and one local government uses hybrid buses[10]. Most bus connections in MW are operated by buses powered by diesel engines. The problem with estimating the exact number of vehicles resulted partly from the rules according to which the rolling stock is allocated to individual lines. In most smaller local governments, operators other than commune companies route buses that are also used for other connections (e.g. commercial). This means that the Organiser does not reserve the right to assign vehicles exclusively to its network/line. This also results in a limited impact on the visual aspect of the vehicles, which is discussed later in this chapter.

The choice of the type of drive used in public transport vehicles is also an important aspect when planning connections. Each of them requires dedicated infrastructure and appropriate technical support. Depending on the chosen strategy of the local government unit, as well as the financial and infrastructure capabilities, the vehicle drive may be more or less important, and the selected type of vehicle power supply may even be preferred. In bus transport in the Warsaw Metropolitan Area, vehicles with the following drives were identified:

- ON - diesel, diesel fuel;
- CNG/LNG – compressed/liquefied natural gas;
- HEV – hybrid, a combination of ON or CNG and electricity;
- EV – electric drive.

Additionally, the types of drives presented above can be divided into three groups, i.e. emission, low-emission and zero-emission. It should be added that rolling stock powered by hydrogen cells is classified as zero-emission. It is possible that in the future such vehicles will be used more widely in the Navy, as the City of Warsaw does not rule out the use of this drive. Each of the drives presented above has both advantages and disadvantages, which are related to their efficiency, operating costs, and impact on the natural environment.

[10]The city of Otwock has 2 used Solaris Urbino 18 hybrid buses of the third generation.

In selected metropolitan local governments, however, **electric buses** operate, a list of which can be found in Table 1. Additionally, in the near future, more electric buses will appear in the MW local government units, as relevant tenders have been or will be conducted in the City of Warsaw and the Michałowice commune.[11]

Table 1. Electric buses in MW local government units

PTZ organiser	Operator	Vehicle brand	Number of pieces
City of Warsaw			
ZTM	Commune Bus Company	Solaris Urbino 12 electric 3rd gen.	10
ZTM	Commune Bus Company	Solaris Urbino 12 electric 4th gen.	10
ZTM	Commune Bus Company	Solaris Urbino 18 electric IV gen.	131
ZTM	Commune Bus Company	Ursus CS12LFE City Smile	10
Grodziski District			
Grodzisk Mazowiecki commune	PKS Grodzisk Mazowiecki	Solaris Urbino 9LE electric 4th gen.	2
Mińsk district			
the city of Mińsk Mazowiecki	ZDiTM in Mińsk Mazowiecki	MAN Lion's City 12 E	6
Nowy Dwór district			
Pomiechówek commune	"MAGNET-TRANS" Bartłomiej Obraziński; Obraziński Transport Group Sp. z o.o.	Solaris Urbino 12 electric 4th gen.	1
Pomiechówek commune	"MAGNET-TRANS" Bartłomiej Obraziński; Obraziński Transport Group Sp. z o.o.	Solaris Urbino 9LE electric 4th gen.	3
Pruszkow district			
the city of Pruszków	PKS Grodzisk Mazowiecki; PKS Gostynin	Solaris Urbino 9LE electric 4th generation	2
West Warsaw district			
ZTM in Warsaw	Public transport Łomianki	Solaris Urbino 12 electric 4th generation	2

[11] https://ezamowienia.gov.pl/mp-client/search/list/ocds-148610-aa5d317a-e1f7-11ee-9fce-3adbe5eb3a3d (accessed: 30.09.2024 r.)

PTZ organiser	Operator	Vehicle brand	Number of pieces
TOTAL			**171**

Source: Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on data from local government units

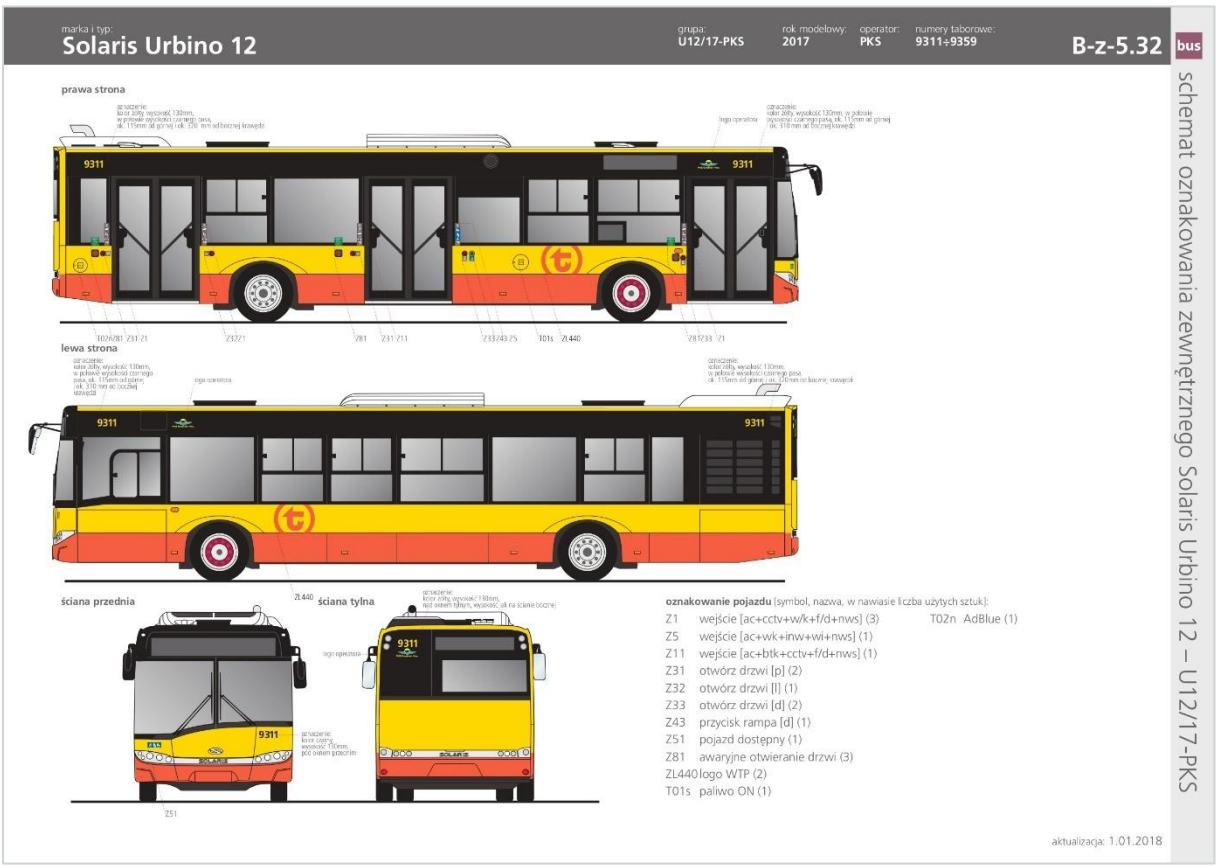
Despite the lack of complete data and the need to use certain estimates, it is possible to determine the standard of the rolling stock of bus operators and carriers in the Warsaw Metropolitan Area. Statistically, it is a **MAXI class vehicle with a conventional drive.** However, it should be taken into account that the age of the vehicles was not verified during the analysis process, which is of significant importance in the case of conventional vehicles. The differences in technical solutions used in the latest diesel engines (meeting EURO6 exhaust emission standards) differ significantly from those implemented in even 20-year-old vehicles driving around the Warsaw Metropolis.

An overview of the bus rolling stock used
in the Warsaw Metropolitan Area can be found in the sheet "Rolling stock" in the file:
Appendix no. 1 - database

A very important element of the rolling stock is its **visual identification**. It means not only passenger information elements (e.g. external and internal displays), but also the painting of vehicles and the pictograms placed on them. Thanks to the use of coherent visual identification of rolling stock (including stop infrastructure and IT systems), a potential passenger can more easily recognise the vehicles (and infrastructure) of a given Organiser or commercial carrier.

The WTP network managed by ZTM in Warsaw should be considered the most unified and widely used visual identification of rolling stock. This entity has dedicated studies, i.e. "*Book of visual identification of vehicles serving lines organised by the Public Transport Authority*" and "*WTP visual identification manual*" indicating, among other things, requirements for the applied painting of rolling stock and placement of logos.

Figure 2 . A fragment of the "Book of visual identification of vehicles serving lines organised by the Public Transport Authority"



Source: https://www.ztm.waw.pl/ksiega_identyfikacji_wizualnej_pojazdow.pdf (accessed 01.10.2024).

PL	EN
Marka I typ	Brand and type
grupa	group
Rok modelowy	Model year
operator	operator
Numery taborowe	Vehicle numbers
Prawa strona	Right side

Schemat oznakowania zewnętrznego Solaris Urbino 12 – U12/17-PKS	External marking scheme Solaris Urbino 12 – U12/17-PKS
Oznaczenie: kolor żółty; wysokość 130mm; w połowie wysokości czarnego pasa, ok. 115mm od górnej i ok. 320 mm od bocznej krawędzi	Marking: yellow; height 130mm; halfway up the black stripe, approx. 115mm from the top and approx. 320 mm from the side edge
Logo operatora	Operator logo
Lewa strona	Left side
Ściana przednia	Front wall
Oznaczenie: kolor czarny, wysokość 130mm, pod oknem przednim	Marking: black, height 130mm, under the front window
Ściana tylna	Rear wall
Oznaczenie: kolor żółty, wysokość 130mm, nad oknem tylnym, wysokość jak na ścianie bocznej	Marking: yellow, height 130mm, above the rear window, height as on the side wall
Oznakowanie pojazdu [symbol, nazwa, w nawiasie liczba użytych sztuk]:	Vehicle marking [symbol, name, number of pieces used in brackets]:
Wejście	Entrance
Otwórz drzwi	Open doors
Przycisk rampa	Ramp button
Pojazd dostępny	Vehicle available
Awaryjne otwieranie drzwi	Emergency door opening
Logo WTP	WTP logo
Paliwo ON	DIN fuel
Aktualizacja: 1.01.2018	Update: 1.01.2018

When describing the visual identification of buses operating on behalf of the capital's Public Transport Authority, it is impossible not to notice the colour distinction of vehicles serving local lines, the so-called "eLs". These vehicles feature a different external paint job complemented by the characteristic letter "t" in brackets – the WTP logo (see: Photo 1.). Buses serving the “L” lines also stand out in terms of their length and drive compared to the rolling stock operating in Warsaw. Typically, these are MINI or MIDI class buses with conventional drive, although in the past hybrid buses also appeared on these lines.

Photo 1. ZAZ A08 while serving the L-26 ZTM line

Source: https://www.wtp.waw.pl/wp-content/uploads/sites/2/2020/11/04-1.jpg (accessed 01.10.2024).

Among the other PTZ Organisers in the Warsaw Metropolitan Area, a network was identified in which the buses operating have a visual identification almost identical to the "Warsaw" one. Since the beginning of its activity, the district-commune Union Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport] has required a coherent visual identification, which in terms of external appearance is identical to the one used in the ZTM network in Warsaw. In fact, the only external feature that distinguishes the vehicles of both Organisers is the pictogram placed on the side of the vehicle - a stylised letter "G" in the case of GPA or the WTP logo. Moreover, some vehicles, after the end of their contract in the WTP network, continue to operate on GPA lines only by changing the logo (see: However, the current disadvantage of such a system is that identical colours may mislead passengers. High usage of the PTZ network based on strong habits may result in cases of using buses of the mentioned Organisers by mistake. However, this problem would be completely solved in the case of transport integration on a metropolitan scale.

Photo 2.). Thanks to such a strategy, in the event of transport integration activities between these two networks, visual adaptation of the rolling stock would be practically hassle-free. However, the current disadvantage of such a system is that identical colours may mislead passengers. High usage of the PTZ network based on strong habits may result in cases of using buses of the mentioned Organisers by mistake. However, this problem would be completely solved in the case of transport integration on a metropolitan scale.

Photo 2. Solaris Urbino 8.9LE (operating in the years 2016-2024 in the WTP network) operating on line 24 of Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport]

Source: https://gpa.grodzisk.pl/solarisy-urbino-89-le-na-liniach-gpa/ (accessed 01.10.2024).

Other Organisers of bus transport in MW influence the visual aspect of the rolling stock serving their lines to varying degrees. Most often, however, the interference is limited to requiring the use of directional signs (electronic or analogue) in vehicles or the placement of the organiser's logo (e.g. the coat of arms or the name of the commune). Importantly, when a commune has its own rolling stock and outsources its management to external entities, **vehicles within one network or even one line may differ significantly from each other.** An example is the free line 10 organised by the city of Pruszków, which is operated by electric vehicles.[12] Buses on this line, despite operating within the same public transport network, stand out visually from the rest of the rolling stock running in Pruszków and the surrounding area (see:

[12]Two Solaris Urbino 9LE electric buses were purchased as part of a joint tender conducted by the communes of Pruszków, Żyrardów and Grodzisk Mazowiecki. According to it, a total of 6 vehicles were purchased (2 for each commune). Each bus has the same equipment and painting, and is distinguished only by an inscription with the name of the commune located above the window line.

Photo 3.).

The diversity of the bus rolling stock also results from the requirements placed on operators by entities entrusting them with the operation of the lines. The vast majority of communes and districts limit this aspect to the necessary minimum (i.e. placing the organiser's logo and the number/name of the transport line), or practically omit it, indicating in tenders only requirements regarding the type or drive of the vehicles. The list of vehicles serving bus lines in MW, illustrated in Photo 4, shows the multitude of visual solutions used.

Photo 3. Public transport buses in Pruszków (from the left: Solaris Urbino 9LE electric and ZAZ A08)

Source: https://www.obiektywna.pl/pruszkow/startuje-pruszkowska-linia-10 (accessed 08.10.2024), https://www.pruszkow.pl/komunikacja/dodatkowe-linie-autobusowe-na-dni-pruszkowa/ (accessed 08.10.2024).

Photo 4. Buses in the MW local government unit (from the left: Pomiechówek commune, Łomianki city, Mińsk Mazowiecki city, Legionowo district)

Source: https://www.facebook.com/GminaPomiechowek (accessed 08.10.2024), http://kmlomianki.info/nasze-autobusy.html (accessed 08.10.2024), https://powiat-legionowski.pl/dla-mieszkancow/bezplatne-linie-powiatowe/mozliwe-zmiany-w-kursowaniu-autobusow-w-dniach-20-21-marca (accessed 08.10.2024), https://www.facebook.com/MobilnyMińsk (accessed 08.10.2024).

The presented examples of visual identification used in various MW local governments could constitute a separate case study. However, it can be stated that within the framework of bus transport in the MW local government units, many different methods of identifying vehicles operating on PTZ lines are used. However, in the context of the conducted analysis, it should be noted that the visual diversity of the rolling stock is a certain limitation in the unification of bus transport on a metropolitan scale. From a passenger's perspective, the visual consistency of the bus rolling stock plays a significant role. Uniform visual identification of vehicles not only facilitates the identification of those belonging to a given Organiser, but also translates into creating the image of the public transport network in the area. By using a unified appearance for the bus rolling stock, you can also influence the image of your local government.

2.6. ACCESS TO BUS TRANSPORT INFORMATION

The availability of information on bus transport concerns the presentation of timetable and tariff data in both digital and analogue form. The transparency of the transport system for passengers not only facilitates everyday travel for residents and tourists, but also increases the attractiveness of public transport.

Most communes and districts located in the Warsaw Metropolis provide information on public transport on their websites, such as routes, ticket tariffs and timetables. In most cases, this information is easily accessible and the data is presented in a clear and transparent manner. However, you can find local government websites where information about the PTZ offer is actually hidden. A certain tendency can be noticed here - the vast majority of communes in which the Organiser of bus transport is the Warsaw ZTM, the distict responsible for the commune or the distict-commune Union is redirected to the Organiser's website. This does not mean that timetable or tariff data are not available in other cases.

Timetables are a key piece of PTZ information that enables you to plan your journey. The basic form of providing this information is a paper timetable placed at the bus stop. Currently, it is also difficult to find bus lines in MW that do not have timetables on the transport Organiser's website. Some Organisers and local governments, however, go a step further. Thanks to the use of digital timetable data, as well as information from GPS transmitters, **dynamic passenger information systems (SDIP)** can be seen at an increasing number of stops. They show actual or scheduled bus arrival times, delays and other information about transport operations. The signs differ between MW local governments, as shown in the photos below.below

It is worth mentioning that in the case of the City of Warsaw, information about bus connections on SDIP boards is only visible at stops connected with trams (e.g. on the W-Z route). Bus connections organised by the capital city's Public Transport Authority are visible on **LCD boards** placed in the city of Piaseczno (see: Photo 5.). However, WTP is not the only network in MW whose subsequent bus routes are visible on SDIP boards. In 2024, boards using e-paper technology were installed at 11 stops in the communes of Grodzisk Mazowiecki, Milanówek and Żabia Wola. They show the GPA bus routes. As the Organiser points out, this solution is cheaper both to purchase and to operate.

Photo 5. SDIP board at the Kusocińskiego 02 bus stop in Piaseczno

Source: https://piaseczno.eu/elektroniczne-tablice-na-przystankach/ (accessed 01.10.2024).

Photo 6. SDIP board (e-paper) at the Siestrzeń Rozalińska 02 bus stop

Source: https://gpa.grodzisk.pl/tablice-z-e-papieru-na-przystankach-gpa-pierwsze-tego-typu-w-polsce/ (accessed 01.10.2024).

Transparent information about ticket prices, types of discounts available and how to purchase them should be easily available at stops, on vehicles, at points of sale and online. **Tariff information regarding bus transport in MW is most often available on the Organisers' websites.** Of all the MW local government units, as many as 66 provide information there (in various forms) about the PTZ offer in their area. However, 11 communes and 2 districts [13] do not have a section dedicated to public transport on their websites.

A summary of information on bus transport in individual MW local government units can be found in the "PTZ information" sheet in the file:
Appendix No. 1 - database

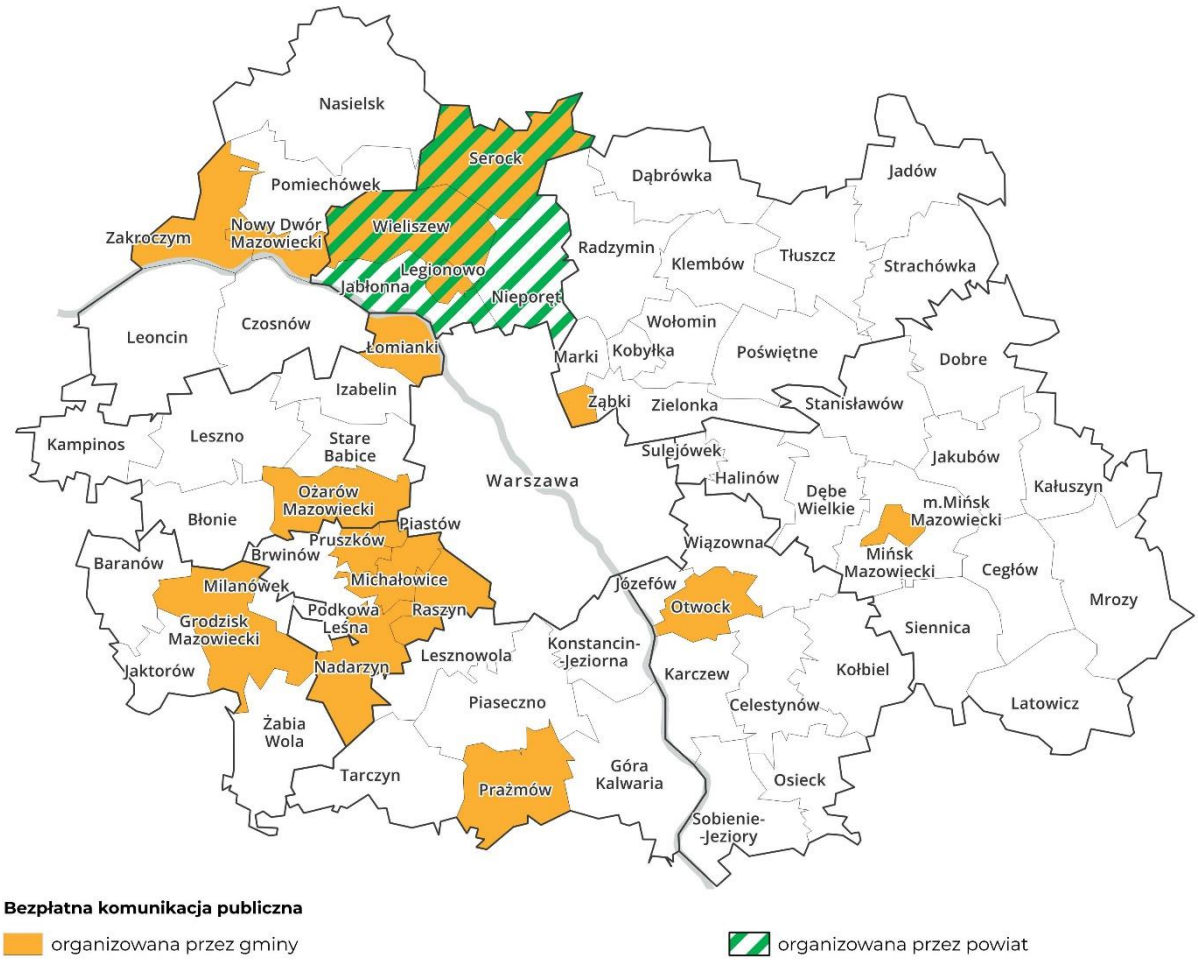
In the context of the ticket tariff, it is impossible not to include information about the methods of purchasing tickets. Mobile applications and websites are becoming more and more popular, allowing you to quickly check the current tariff and purchase a ticket remotely. It is important here to regularly update the data provided to external entities so that passengers have access to reliable information, especially in the event of price changes. Despite this, the **basic ticketing medium in MW is still paper tickets** – all paid systems use this form. Some Organisers also provide passengers with the option to purchase tickets in digital form. In addition, only the Warsaw ZTM allows long-term tickets to be encoded on dedicated cards.

The city's **ZTM** provides access to purchasing tickets in many ways: paper tickets can be purchased from ticket machines located at stops or in vehicles, as well as at ZTM passenger service points (so-called POP), while e-tickets can be purchased via the following websites: Jakdojade, Skycash, moBILET and mPay. Long-term tickets can be purchased at ZTM passenger service points and ticket machines, as well as in the dedicated mobiWAWA mobile application. For **GPA**, **ZGOPGP** and **PGZTPPM** the ticket purchasing system looks different from the one in Warsaw. For journeys organised by the above-mentioned entities, it is possible to purchase a single ticket from the driver – however, the option to purchase online or via the app is not available. It is worth mentioning that it is now possible to purchase long-term GPA tickets online. The most common method of selling tickets for journeys organised by other MW local government units is to purchase a paper ticket directly from the bus driver. In the case of the Ożarów Mazowiecki and Grodzisk Mazowiecki communes, where the transport operator is PKS Grodzisk Mazowiecki, tickets can be purchased via the e-podróżk portal.

[13]The communes of Jadów, Jakubów, Kałuszyn, Kampinos, Latowicz, Mińsk Mazowiecki, Mrozy, Stanisławów, Strachówka, Tarczyn and Wiązowna and the districts of Nowy Dwór and Pruszków.

Also worth noting here are systems that are free of charge. BKM, i.e. **free public transport**, currently operates in bus transport organised by: Legionowo district, the city of Legionowo, the Serock commune, the city of Mińsk Mazowiecki, the city of Nowy Dwór Mazowiecki, the Zakrętym commune (only within the commune boundaries), the Prażmów commune, the city of Pruszków (for holders resident card), Nadarzyn commune, Piastów town, Raszyn commune, Łomianki commune and the city Ząbki. Moreover, in selected communes where local buses of the Warsaw Public Transport Authority's "L" line run, passengers with resident cards of a given commune can travel free of charge within the administrative borders of the relevant commune.

Map 15. Local governments offering free bus transport in the Warsaw Metropolitan Area

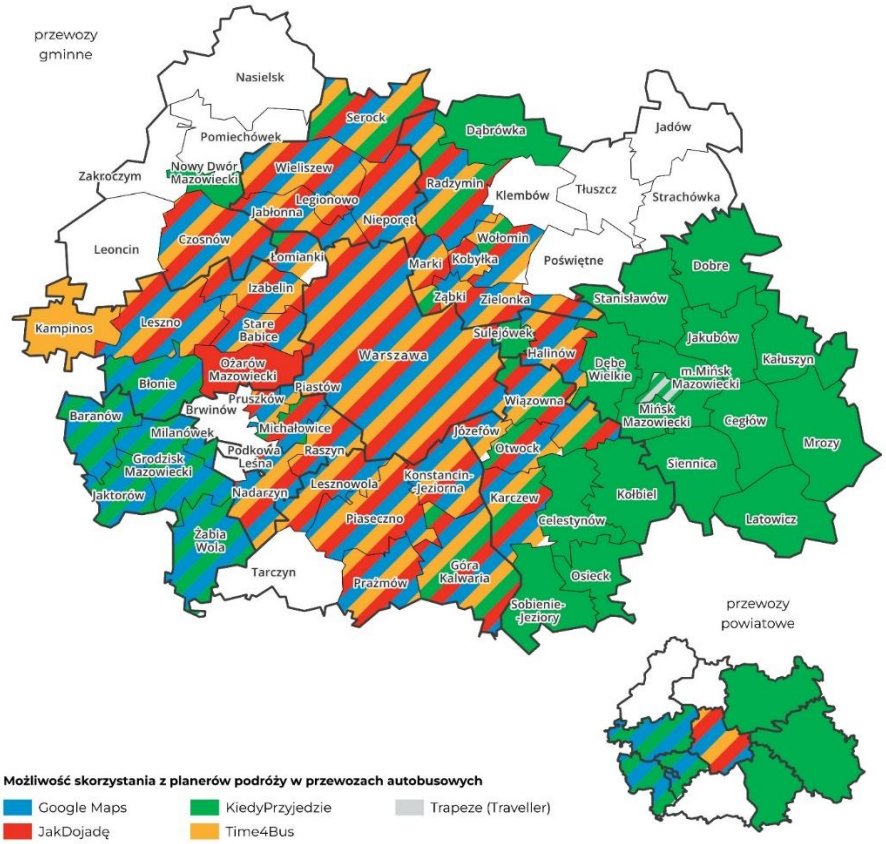


Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on local government data.

PL	EN
Bezpłatna komunikacja publiczna	Free public transport
Organizowana przez gminy	Organised by Communes
Organizowana przez powiat	Organised by the district

When verifying the availability of information about PTZ, it is difficult not to mention **journey planners**, which are becoming an increasingly popular form of searching for connections on the routes chosen by passengers. Collecting the most important information on the functioning of transport in digital form is a fundamental element in the process of increasing the accessibility and convenience of traveling by public transport. The next step is to make the collected data available to recipients – passengers, but also to route planning applications. The availability of digital forms of verification of timetables or bus routes is also extremely important for people with various types of disabilities. The use of online planners certainly facilitates the travel process for all passengers (including people with limited mobility), enabling easy route planning, checking timetables and information about the current location of the vehicle. Thanks to these solutions, people travelling by public transport can quickly and conveniently find the most convenient connections for them, also taking into account transfers, which translates into time savings.

Map 16. Use of travel planners in the Warsaw Metropolitan Area



Source: Own study of the Economic Advisory Team TOR Sp. z o.o. based on local government data.

PL	EN
Możliwość skorzystania z planerów podróży w przewozach autobusowych	Possibility of using travel planners in bus transport
Przewozy powiatowe	District transport
Przewozy gminne	Commune transport

The travel planners used by JST MW include: Google Maps, jakdojade.pl, Time4Bus, Trapeze (Traveller) and kiedyPrzyjedzie.pl. It is worth mentioning here several PTZ

Organisers from MW who are characterised by high availability of data provided to the most popular travel planners, i.e.: ZTM in Warsaw, Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport], the Serock commune, Nowy Dwór Mazowiecki or Otwock.

As mentioned earlier, the largest Organisers of bus transport in the Warsaw Metropolitan Area are: ZTM (37 local government units – Warsaw, 34 communes and 2 districts), GPA (10 communes), PGZTPPM (ultimately 14 communes) and ZPGOPGP (10 communes). All of these Organisers **provide travel data** to travel planners, which significantly facilitates travel planning in the vast majority of MW local government units. It is worth noting, however, that there are cases in which the Organiser does not share its data, and only larger entities do so. Examples include the commune of Nadarzyn or the city of Legionowo. Another problem is the fact that in some communes there are few lines with the ability to track trips online, which limits the availability of information about other connections that are not included in the trip planners. Despite the wide use of open data, missing information about some lines may make it difficult for travelers to use the full public transport offer. The analysis of the availability of digital timetable data showed that as many as 21 communes in the Warsaw Metropolis do not have any lines available in the above-mentioned planners.

2.7. SUMMARY

The problems identified in the chapter strongly affect the quality of the entire current PTZ system in the metropolis and the potential difficulty in its integration. Many shortcomings and incorrect assumptions may result in serious problems when taking action to consolidate and integrate the analysed network. Nevertheless, these are difficulties that can and should be overcome. From the passenger's point of view, it will be crucial to strive to change the communication system in such a way as to improve the transport accessibility of all those areas that are currently characterised by the lowest value, as well as to simplify and unify the marking of lines. In turn, looking from the organisational side, it will be very important to sort out legal, organisational and management issues, as well as to introduce an appropriately high standard of providing and disseminating information about transport. There is also much to be done in terms of standardisation and improvement of the quality of rolling stock.

Nevertheless, it should be emphasised that the multitude of connections currently available in the MW area is an excellent basis for the development of the entire system. This means that there is a real (and potential) demand for public transport, as well as an initial input for planning a more coherent connection network. There is already a large base of the necessary rolling stock, as well as entities ready to provide their transport and management services. It can be assumed that all these elements have development potential, and their proper integration and targeting of further activities will result in a significant increase in the number of passengers, and thus a noticeable continuous increase in the transport performance of public transport and a simultaneous stabilisation or even decrease in the value of transport performance in individual transport.

The main problems identified in the MW PTZ network system and its individual elements are:

- the existence of **too many entities** involved in the organisation and execution of transport and, to some extent, a lack of coherence between their activities. Although it is also a fact that to a large extent the individual entities also complement each other, which is a good contribution to their cooperation.
- **incorrect approach to marking lines**, resulting in a lack of consistency in numbering on a metropolitan and local scale, as well as duplication of markings.
- **inconsistency of timetables** between the content contained in certificates and permits and that provided to passengers in electronic or paper form.
- **occurrence of gaps in information** about timetables, for example in the form of not including selected courses/lines in the timetables provided.
- **too many variants** of selected communication lines, making them illegible and making it difficult for users to understand the system. This also applies to the diversity of labeling of individual variants.

- the occurrence of **linear barriers of anthropogenic origin**. In contrast to natural barriers, such as forests or rivers common in the analysed area, which block the possibility of connecting individual neighbouring areas, barriers resulting from human activity are a significant blockade to the development of the system. As the analysis has shown, the main barrier of this type are the boundaries of individual local government units, primarily districts. There are many places in the network where there is a noticeable lack of or very few inter-district connections, e.g. on the border of Otwock and Mińsk districts and Mińsk and Wołomin districts. This problem is also visible in the matter of inter-commune connections. These difficulties are caused strictly by organisational and legal issues.
- **too few runs** on many lines, especially those away from the metropolitan core. While the lines running along the main transport corridors maintain an acceptable frequency, in other areas the number of services is low, very low or even non-existent. Such an offer is in no way competitive, and certainly does not encourage potential users to use PTZ. It can be assumed that in such a situation only those passengers who have no other transport alternative will use it.
- the validity of potentially **many permits that are too old**, the validity of which is difficult to verify, among others due to the too low standard of the transport services offered.
- use of an **excessive number of additional markings** on timetables, which again significantly limits their readability and makes it difficult to understand the functioning of the entire system and the actual operation of individual lines. This problem is directly related to the excessive use of variant rates.
- **sloppy preparation of timetables** resulting in many typos, alternative or incorrect names of stops/exits, as well as the use of markings that are not explained in any way on a given timetable.
- **deficiencies in locating and organising the ends, as well as inconsistent naming of them**, resulting in, for example, their poor readability or difficulty in use.
- **lack of visual unification of PTZ**, which applies not only to rolling stock, but also to information on websites, bus shelters and timetables.
- **the multitude of journey planners used by bus connection Organisers**, which on the one hand facilitates travel planning, but on the other hand, due to the dispersion of information, highlights the problem of the lack of a single planner aggregating all connections in MW, which makes the process of using connections from different Organisers difficult.

3. BUS TRANSPORT INTEGRATION PLAN IN MW

3.1. NATIONAL CONDITIONS

Effective integration of bus transport in the Warsaw Metropolitan Area requires coordinated actions. The model of organising and financing public transport in the MW area is complex, which is the result of historical and legal conditions. The main issues shaping the current image of the functional model include:

- the lack of a metropolitan act for the Warsaw Metropolis or the lack of a metropolitan act for monocentric cities that would enable the organisation of metropolitan passenger transport;
- inability to establish voivodeship-district-commune Unions that would enable the organisation of all transport within the voivodeship. The solution was proposed in the National Urban Policy until 2030, but by the time the analysis was prepared, statutory solutions had not been developed;
- the functioning of a large number of Organisers of public transport based on the Act on Public Transport – each of the Organisers with its own standards for the organisation of transport, passenger information and ticket pricing;
- lack of a stable and well-targeted source of financing for transport other than public transport – the Bus Transport Development Fund (FRPA) in operation since 2019 prefers to grant funding to communes, not district-commune Unions, which ensure integration on selected (larger in terms of area) fragments of the MW. The above-mentioned principles encourage smaller Organisers of public collective transport to organise their own passenger transport, which leads to the fragmentation and disintegration of the public collective transport system in the functional areas of cities. Representatives of the organisers report that in 2025 there may be a lack of financing for district-commune Unions due to the high interest of Communes in the Fund. Industry organisations are also submitting demands to include public transport connections in the FRPA. The Ministry of Infrastructure announced work on modifying the rules of operation of the FRPA;
- functioning of operators – own entities.

The integration of bus transport is also hindered by legislation in terms of tariff and ticket integration and information in the field of:

- **statutory discounts**, which are established on the basis of various provisions, in particular in the Act on entitlements to discounted travel on public transport, as well as tariff resolutions of local Organisers based on Art. 46, sec. 1(6) of the Public Transport Act. As a result, statutory discounts for rail and bus transport are different. A similar situation also occurs between public transport and other bus services.
- **access to timetable data** – in Poland there is no nationwide electronic repository of timetables and bus stop locations (the National Access Point to multimodal travel information services operates only in the form of an Excel file with links to external websites). Permits to perform regular transport in domestic road transport pursuant to Article 18 of the Road Transport Act are issued by various levels of local government units, and timetables attached as an appendix do not allow their reuse in connection search engines. This significantly complicates the inventory of bus transport, as well as the reuse of information in passenger information systems. Moreover, each Organiser organises its own passenger information system, which may be incompatible with the systems of other Organisers.

The basic assumption of a transport Organiser's actions should be to provide a service tailored to the expectations of current and future passengers. For public transport to become an alternative to car travel, it must provide **a high level of user experience.** Integration activities should be aimed at increasing the positive reception of the entire PTZ service. Typically, passengers evaluate the public transport system from the point of view of one carrier or operator with which they had contact during their journey. Therefore, individual negative feelings are transferred to the assessment of the entire system, which is, after all, one alternative to car travel. Full access to information about tariff systems, prevailing habits in public transport (e.g. ticket payments), regulations of each Organiser, operator and carrier results in an increased sense of "service certainty". Ensuring a uniform standard, especially in access to information, also applies to system reliability (the certainty that the information provided is reflected in reality). A uniform standard also increases the ergonomics of operation and the level of access to information in one place, which builds broader trust in public transport understood as an entire service. By ensuring an approach based on high quality, readability and reliability, the passenger will be able to more easily understand the principles of bus transport throughout the metropolis, which should be user-friendly in terms of the rules applicable therein.

3.2. FINANCE – ONE OF THE KEY OBSTACLES TO INTEGRATION

Activities aimed at organisational, tariff-ticketing and passenger information integration depend on the financial capabilities of the Organisers. In recent years, local governments have been struggling with the problem of access to financial resources to perform their own tasks, including: in the field of public transport. Local governments located in the vicinity of cities organising public transport often have problems with organising connections. Local government units that want to join the currently operating agreements are resigning due to the cost barrier resulting from the appropriate maintenance of service standards. In the case of the signatories of the agreements, there is a problem with maintaining the current public transport offer while maintaining an appropriate standard of services and increasing costs. Ultimately, smaller local governments decide to withdraw from the agreement in favour of organising transport that allows them to collect funds from the FRPA and refund statutory reliefs or those financed from their own funds, which is a significant burden for them. This ultimately leads to system disintegration.

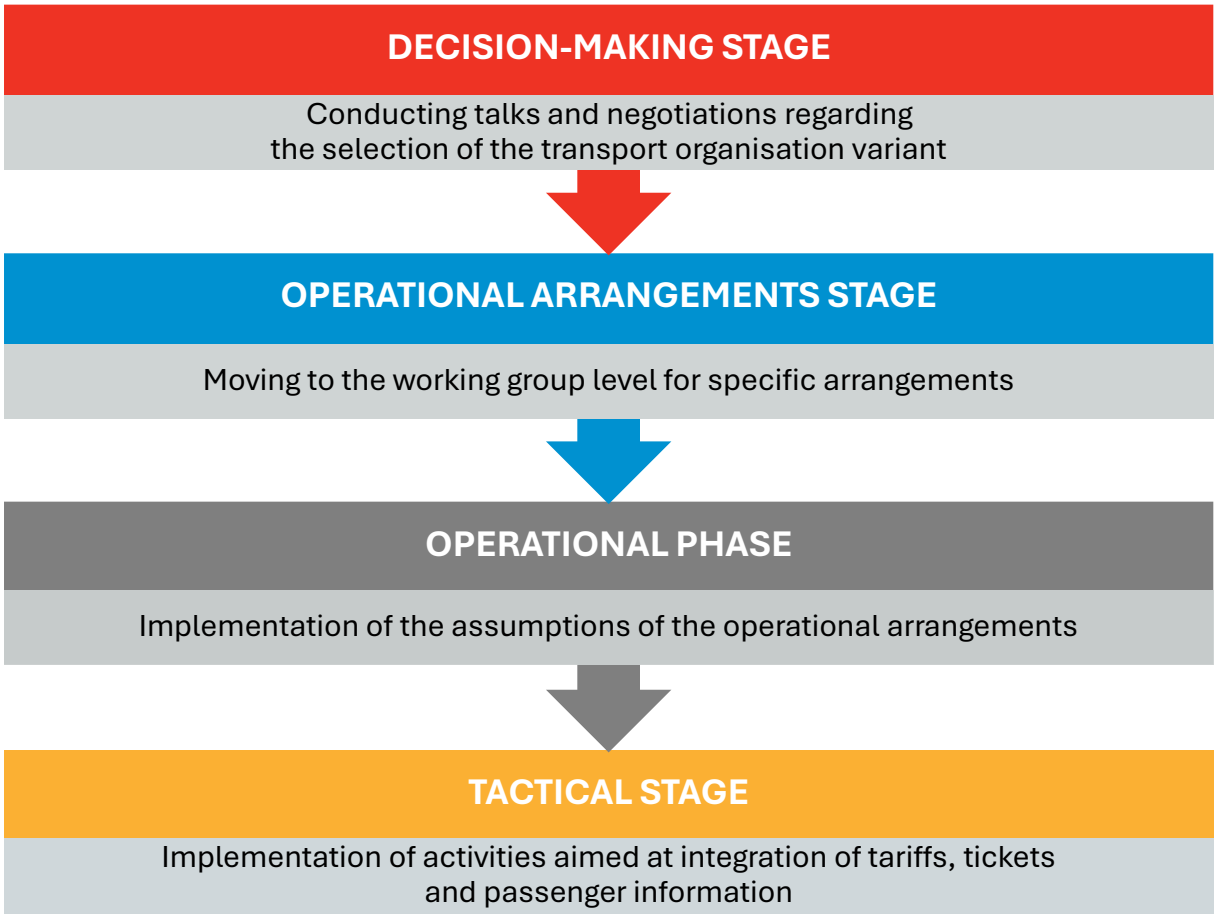
Finances are also one of the key obstacles to fare and ticket integration, where there may be a loss of ticket revenues due to mutual acceptance of tickets or differences in applied discounts. An example would be the operation of the ZTM-KM-WKD Common Ticket offer, which requires large financial outlays from local governments. It is worth adding that a tariff and ticket offer integrating bus and rail transport should function in every metropolis.

The above-mentioned situations indicate that **the will and willingness of those interested is not enough for integration activities, but also the provision of appropriate sources of financing,** e.g. funds from the state budget for each local government unit for the organisation of local public transport or additional revenues from personal income tax thanks to the establishment of metropolitan union.

3.3. How to start? Action plan

In order to make effective decisions regarding organisational, tariff and ticket integration and passenger information in the long term, it is necessary to take the following actions:

Figure 3 . Sequence of action



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

WHO SHOULD MAKE DECISIONS, NEGOTIATE AND PARTICIPATE IN THESE CONVERSATIONS AT THE DECISION-MAKING STAGE?

- Presidents, mayors, heads of communes of all communes or persons with a clear mandate to speak on their behalf;
- a person responsible for public transport on behalf of the voivodship board (in the context of inter-district rail and bus transport);
- district heads or persons designated by them.

It is easy to notice that the above is de facto the composition of the General Meeting of Members of the "Metropolia Warszawa" Union. It is worth adding that on September 30, 2024, during the General Meeting of SMW Members, resolution no. 13/2024 was adopted regarding: expressing directional consent for the draft act on the metropolitan union in the Mazovian Voivodeship. Before the resolution was adopted, meetings and discussions were held regarding the assumptions of metropolitan transport.

WHO SHOULD BE INVITED TO EXPRESS OPINIONS AND PROPOSE SOLUTIONS?

- Warsaw Public Transport Authority;
- representatives of district and commune unions;
- non-governmental organisations and local action groups.

WHO SHOULD INITIATE ACTION? WHOSE VOTE IS DECISIVE?

- The Public Transport Authority in Warsaw and the Board of the "Metropolia Warszawa" Union, with a special role of the Mayor of the City of Warsaw;
- General Meeting of the Members of the "Metropolia Warszawa" Union.

Once a preliminary framework agreement has been reached at the operational arrangements stage, it is time to move on to the operational talks stage.

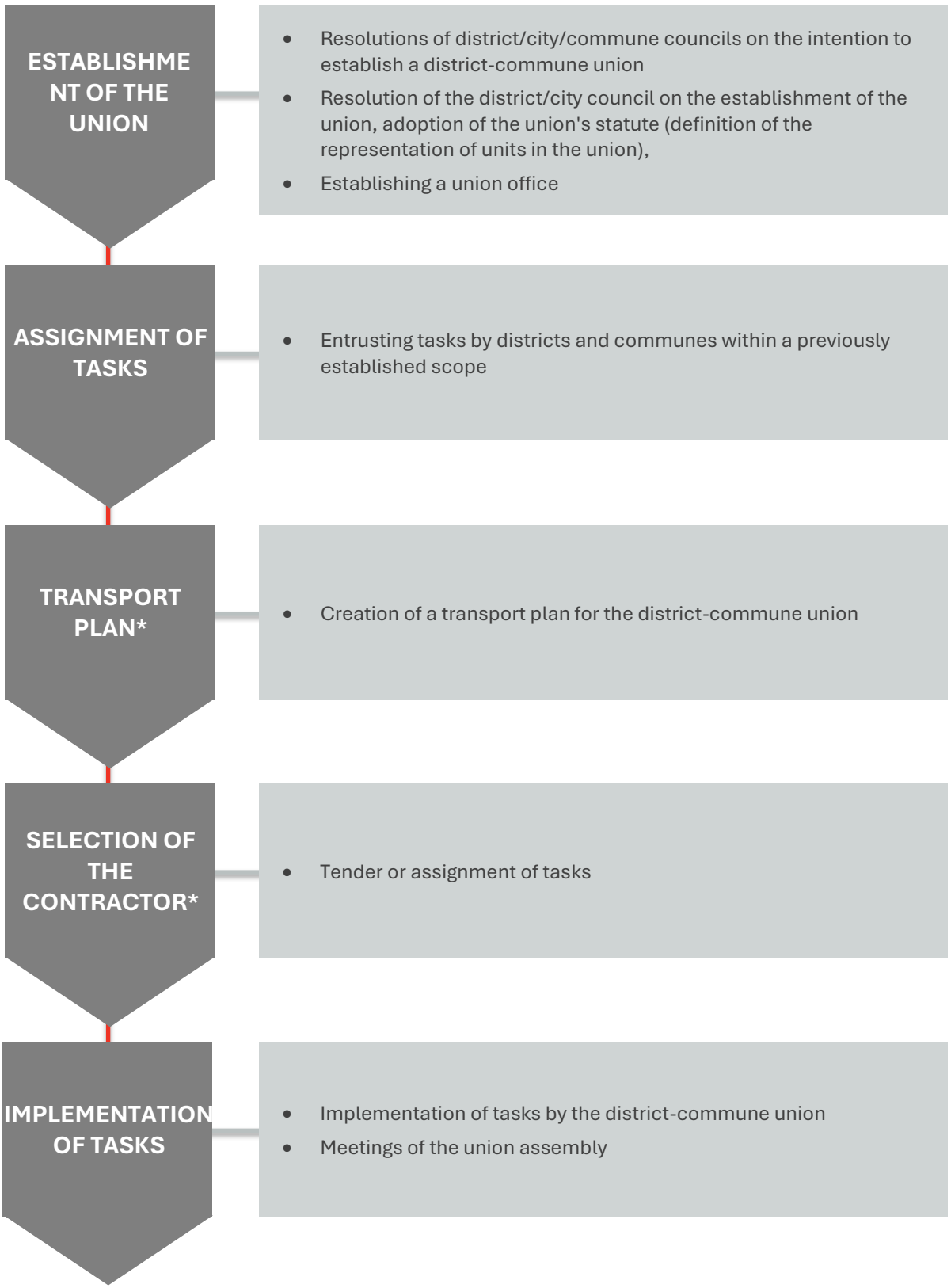
WHAT SHOULD BE DISCUSSED AT THE OPERATIONAL ARRANGEMENTS STAGE?

- scope of integration,
- funding and settlement model,
- the method of fare and ticket integration,
- the way passenger information is provided.

WHAT SHOULD BE THE OUTCOME AT THE OPERATIONAL STAGE?

- in the case of inter-commune agreements – developing a model agreement and signing the agreements;
- in the case of a metropolitan Union – procedural steps aimed at establishing a metropolitan Union and issues related to the Metropolitan Transport Plan and detailing the stage of operational arrangements;
- in the case of a district-commune Union – the activities are presented in the figure below.

Figure 4 . Procedural steps related to the establishment of a district-commune Union



*if transport is entrusted

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

WHAT SHOULD BE THE OUTCOME AT THE TACTICAL STAGE?

- offering an integrated ticket enabling travel on all means of transport included in public utility transport;[14]
- developing a coherent visual identification for transport in the MW, which should include, among others: guidelines on the appearance of stop signs, visual identification of stops, connection diagrams, information messages, marking of transfer hubs and marking of vehicles, regardless of the ownership of the rolling stock or affiliation to a given Organiser;
- developing consistent markings for communication lines, harmonising vehicle markings and the location of directional signs, transport regulations and order rules;
- developing a database of timetables for connections launched in MW and developing principles of cooperation for updating timetable data;
- making timetable data available in GTFS files, which could be made freely available for later use by commercial online route search engines;
- preparing the technical concept of a common passenger information system, which will take into account compatibility with existing passenger information systems and on-board computers in vehicles.

[14]The ticket offer should also include rail transport, which constitutes the transport backbone of MW. Integration with rail transport is a separate issue, since the subject of the study includes bus transport.

3.4. RECOMMENDATIONS FOR ORGANISATIONAL, FINANCIAL AND LEGAL INTEGRATION

The organisation of public transport in the Warsaw Metropolitan Area is currently dispersed. Bus transport is organised by various entities, including: ZTM Warsaw, individual communes, districts, distict-commune Unions. As a result, most of the integrated transport models are present here, but on a smaller scale – inter-commune agreements (ZTM Warszawa) or district-commune Unions.

There are several possible models of organisational integration of public transport in MW:

- inter-commune and district agreement;
- the metropolitan Union in its full version, in which competences are transferred from the current Organisers to the metropolitan level;
- a light/hybrid metropolitan Union, in which there is full tariff-ticket and information integration with the functioning of the current Organisers;
- a district-commune Union, which may be characterised, like a metropolitan Union, by a varying degree of organisational, tariff-ticket and information integration;
- a capital company of local authorities.

On the next page, possible models of organisational integration of transport in the Polish Navy and their advantages and disadvantages are presented in tabular form.

Table 2. Comparison of possible models of organisational integration of public transport in MW

INTEGRATION MODEL	Features	Transport organisers	Advantages	Disadvantages
Inter-commune and district agreements	Partial tariff, ticketing and information integration. Voluntary participation in the agreement.	Current organisers	Maintaining the political status quo.	Lack of refund of statutory discounts on public transport and different discount catalogues. No subsidies from the Bus Connections Development Fund (FRPA) in case of joining the ZTM Warszawa network. The need to sign bilateral agreements with local government units and transport Organisers. No additional revenue from personal income tax for the organisation of the PTZ system
Metropolitan Union (full version)	Full tariff, ticketing and information integration and a single decision-making center. In practice, transfer of competences from the current Organisers to the metropolitan level. Probably the legislator, in consultation with the local government units,	Metropolitan Union (all transport)	Additional funds for organising the PTZ system. Full tariff integration and one decision-making center.	There is no law enabling the establishment of a metropolitan Union. Lack of refund of statutory discounts on public transport and different discount catalogues. No subsidies from the Bus Connections Development Fund (FRPA).

INTEGRATION MODEL	Features	Transport organisers	Advantages	Disadvantages
	will decide on the composition of the union.			Possible complications in the award of contracts for the provision of *in-house* services to companies belonging to local government units. Lack of ability to finance and formal and legal risks of such a scenario due to, among others, the current obligations of transport contracts concluded by the operators of the City of Warsaw, which is the guarantor of long-term loans taken out by transport companies.
Metropolitan Union ("hybrid" / light version)	Full tariff, ticketing and information integration and multiple decision-making centers. Probably the legislator, in consultation with the local government units, will decide on the composition of the union.	Current organisers	Additional funds for organising the PTZ system. Possibility of refunding statutory discounts on transport other than public transport. Support from FRPA for commune and district-commune transport.	There is no law enabling the establishment of a metropolitan Union. The need to change the Act on Public Transport. Many decision-making centers and lack of full influence on the organisational decisions of other Organisers.
District/commune Union	Full or partial tariff, ticketing and information integration and a single decision-making center.	District-commune Union (all or part of transport) or current transport Organisers	Full or partial (depending on the scope of responsibilities) tariff-ticketing and information integration and a	The necessity to change the statute of the current district-commune Unions

INTEGRATION MODEL	Features	Transport organisers	Advantages	Disadvantages
	In practice, transfer of all or part of the competences from the current Organisers to the union offices. Voluntary participation in the union and shaping the scope of its responsibilities.		single decision-making center. Refund of statutory discounts on all transport. Support from FRPA for district and commune transport. Possibility to shape the scope of responsibilities. Local and national experience in shaping district-commune Unions.	in the case of partial integration. Possible complications in the scope of awarding contracts for the provision of *in-house* services to companies belonging to local government units in the case of full integration. No additional revenue from personal income tax for the organisation of the PTZ system
Capital company of local governments	Full or partial tariff, ticketing and information integration. In practice, some competences are transferred from the current Organisers to the company.	Capital company of local governments (all or part of the transport) or current transport Organisers	Possibility to shape the scope of responsibilities.	The necessity to change the statute of the current district-commune Unions in the case of partial integration. Difficult process of adopting an integrated tariff. An organisational model rarely practiced in Poland. Possibility of transferring only part of the competences. No additional revenue from personal income tax for the organisation of the PTZ system

Source: Own study of the Economic Advisory Team TOR sp. z o.o.

3.4.1. COMMUNE AND DISTRICT AGREEMENTS

If the coordinator of the entire process of integration of the bus system in the Warsaw Metropolitan Transport Authority was to be the Public Transport Authority in Warsaw, it would be necessary to sign inter-commune and district agreements by all the Commune Transport Authority local government units with the City of Warsaw, only in the scope of organising passenger information and introducing a special integrated tariff offer. In this case, organisational integration may be significantly hindered due to the loss of the possibility of obtaining subsidies in connection with the costs of financing statutory entitlements to free or concessionary travel or subsidies from the Bus Connections Development Fund (FRPA). Another disadvantage is the lack of additional funds for the organisation of the system in the form of an appropriate share in revenues from income tax from natural persons residing in the area of the metropolitan union.

3.4.2. METROPOLITAN UNION (FULL VERSION)

A comprehensive solution could be to strive to pass a law enabling the establishment of a metropolitan Union, which would make it possible to create a single organiser of public transport and to obtain additional funds for the organisation of the system in the form of an appropriate share in revenues from income tax from natural persons residing in the area of the metropolitan Union. The established metropolitan Union should draw on the experience of the existing MW Union, and by way of a resolution of the Metropolitan Assembly, a Metropolitan Transport Authority should be established, based on the Warsaw Public Transport Authority and the structures of the existing district-commune Unions.

The effects of the activities of an integrated transport Organiser operating within the MW could be:

- a uniform connection network scheme based on common numbering;
- uniform layout scheme;
- common tariff for the area;
- a unified dynamic passenger information management system;
- an online search engine covering all MW connections or providing complete data to commercial operators of websites or mobile applications (timetable data should also include other modes of transport, e.g. railways);
- a map of the position of public transport vehicles in the area, updated “live”;
- uniform vehicle marking regardless of the rolling stock ownership,
- no problems with submitting applications and complaints by passengers (lack of many transport Organisers),
- the possibility of obtaining lower prices for services due to the scale effect (in the case of smaller local governments)
- transferring dispersed staff to one specialised unit – with a similar number of working hours and similar labor costs, we get a much better organised system;

- reducing the number of ordered systems through their unification – fewer ticketing systems, information systems, etc.

However, the appointment of a single transport organiser causes complications in the scope of awarding contracts for the provision of in-house services to companies belonging to local government units (pursuant to art. 22 sec. item 2 of the Act on public transport). The main risks include guarantees for multi-year loans taken out by transport companies or their inclusion in the definition of an internal entity according to Regulation (EC) No 1370/2007 of the European Parliament and of the Council. The **Upper Silesian-Zagłębie Metropolis (GZM)** and its members faced a similar problem. In the case of the Public Transport Company in Katowice (PKM Katowice), it was necessary to develop an appropriate solution through negotiations. In order for a company to become an internal entity, it must be subject to control by the relevant local authority, e.g. by appointing a management board, having a formal majority on the supervisory board or owning a majority of shares. As a result of negotiations, GZM acquired a 1.32% share in the company, and the company's supervisory board was expanded from 6 to 9 people, of which 5 people are representatives of GZM, 3 people were selected from among the company's employees, and one is a representative of the Katowice City Hall. Thanks to this, it was possible to sign a new contract by ZTM GZM with PKM Katowice without commissioning a tender.

In the case of communication lines extending beyond the area of the metropolitan Union, it will be necessary to conclude agreements with other local government units on the basis of which the task of organising public transport will be entrusted to the metropolitan Union pursuant to Art. 7 sec. item 4b(b) of the Act on Public Transport. In the metropolitan act for MW, attention should also be paid to the possibility of concluding agreements with local government units or an Union of local government units, analogously to art. 12 sec. 2 of the act on the metropolitan Union in the Silesian Voivodeship. In order to maintain tariff and ticket integration, it should be stipulated that the tariff will be set by the management of the metropolitan Union, and the proceeds from ticket sales as part of the delegated tasks will constitute the income of the metropolitan Union. The agreement should also define the settlement key, e.g. based on the number of vehicle-kilometers performed within the territory of a given local government unit. The indicated solution operates successfully in the Upper Silesian-Zagłębie Metropolis, which has signed an agreement with 13 communes that are not members of the metropolitan Union.

3.4.3. METROPOLITAN UNION ("HYBRID" / LIGHT VERSION)

An alternative solution is to introduce a so-called hybrid/"light" metropolitan Union, in which metropolitan transport will be a task carried out by the City of Warsaw, despite the functioning of the metropolitan Union. In this solution, the metropolitan union is responsible for coordinating the development of the metropolitan area, and the City of Warsaw, through ZTM, is responsible for developing a functioning public transport system through: new bus connections (e.g. connecting communes that were not connected with each other so far), creating access to standardised information or a single long-term metropolitan ticket. The solution of the hybrid/"light" metropolitan Union also assumes maintaining the current autonomy of the commune, district and district-commune Organisers, which means that there will be different categories of transport - public transport, metropolitan, commune, district, district-commune passenger transport. The application of such a solution makes it necessary to specify such postulates in more detail in the metropolitan act[15], as well as to amend the act on public collective transport, provided that communes, districts and local government Unions are to organise metropolitan passenger transport. Under current law, metropolitan passenger transport is organised only by the metropolitan Union. Changes should also be introduced in Article 15a sec. 2 and 3 of the Act on Public Transport, expanding the catalogue to include district and commune Organisers of passenger transport. The advantage of the hybrid metropolitan Union is the possibility of using the Bus Connections Development Fund to finance connections that are not public transport or metropolitan passenger transport. The functioning of the current autonomy of commune, district and district-commune organisers means that, in addition to the integrated tariff and ticket system, local tariffs of organisers will be able to function. It will also be possible to refund the existing statutory discounts for connections that are not public transport or metropolitan passenger transport. The metropolitan connection network would be established by the Transport Plan, which would be adopted by the General Assembly of the metropolitan Union. In financial terms, the financing of lost revenues due to the acceptance of tickets or metropolitan connections would have to be based on agreements (Article 15a sec. 3 of the PTZ Act).

Due to the current inability to establish a metropolitan Union, it is necessary to seek solutions under the existing law on the basis of voluntary cooperation.

3.4.4. DISTRICT/COMMUNE UNION

One such solution could be the establishment of a district-commune Union. This solution is possible in various variants, characterised by different degrees of integration. In the case of comprehensive integration, the union would be responsible for all aspects of the organisation of public transport throughout MW (on the same principles as the

[15]The Act of October 9, 2015 on metropolitan unions, which entered into force on January 1, 2016, abolished local public transport as one of the tasks of communes and districts included in the metropolitan union. The Act of March 9, 2017 on the metropolitan union in the Silesian Voivodeship, which entered into force on April 7, 2017, restored the provision that allows the organisation of local public transport by communes and districts that are part of the metropolitan union. When creating a metropolitan act for MW, care should be taken not to introduce solutions from the 2015 act and lead to another conflict of provisions with Article 15a of the Act on Public Transport.

Grodziskie Przewozy Autobusowe [Grodzisk Bus Transport] district-commune union). In this solution it is possible to finance transport through the refund of statutory reliefs or the Bus Connections Development Fund.

In the case of partial integration, the union could be responsible for tariff, ticket and information integration while maintaining the autonomy of the existing Organisers to shape the transport network. However, it would be necessary to change the statutes of the current district-commune Unions in order to avoid duplication of competences between the Unions. The next step in future integration could be the shaping of the communication network. It would also be the first step in creating the Metropolitan Transport Authority, of course if the metropolitan act is adopted (as was the case with the Commune Transport Union of the Upper Silesian Industrial Region – KZK GOP). The disadvantage of this solution is the lack of additional funds for organising the system in the form of 5.75%. share in income tax revenues from natural persons residing in the metropolitan area.

An example of such a solution is another commune Union in the form of an inter-commune Union – the **Metropolitan Transport Union of the Bay of Gdańsk (MZKZG)** in the area of Gdańsk, Gdynia, Pruszcz Gdański, Reda, Rumia, Sopot, Wejherowo and neighbouring communes. The task of the Union is to shape a common communication policy and ensure conditions for the proper functioning of an integrated ticketing system in the form of a metropolitan ticket. The Union also provides on its website links to the timetables of railways, trams, trolleybuses and buses operated by the Pomeranian Voivodeship, ZTM Gdańsk, ZKM Gdynia and MZK Wejherowo. MZKZG also provides a wiring diagram and links to a commercial connection search engine. From April 2022, a Regional Combined Ticket was introduced, valid with the above-mentioned transport Organisers and regional bus carriers: PKS Gdynia, PKS Gdańsk and P.A. GRYF.

mzkzg.org

Kolej Tram BUS Trol

3.4.5. CAPITAL COMPANY OF LOCAL AUTHORITIES

An alternative solution may be the establishment of a capital company of local governments. In this organisational form, it is possible to delegate tasks to the company in the field of developing timetables, creating passenger information or ticket distribution. Other tasks, such as introducing a ticket based on an integrated tariff, developing tariff rules, adopting transport plans, concluding contracts for the provision of public collective transport services with operators and carriers, establishing and defining transport stops and the rules of their use can only be carried out in the form of cooperation between the company and a local government unit or a district-commune Union. This means that adopting an integrated tariff may be difficult due to, for example, the lack of consent from one commune. Moreover, the statutes of the current district-commune unions should be changed to avoid duplication of competences between the unions and the company. The disadvantage of this solution is the lack of additional funds for organising the system in the form of 5.75%. share in income tax revenues from natural persons residing in the metropolitan area.

An example of a local authority capital company in the field of public transport is **InnoBaltica** sp. z o.o., which is responsible for **the FALA system**. It is a modern platform for planning trips and paying for public transport in the Pomeranian Voivodeship. It will cover rail transport routes (agglomeration and regional trains, i.e. POLREGIO and PKP SKM trains in Tricity) and public transport routes organised by: Gdańsk, Gdynia, Słupsk, Wejherowo, Tczew, Chojnice, Lębork and Puck, i.e. part Tricity Agglomeration. The system will create a database that will contain, among other things, passenger accounts, information on ticket prices, train, bus, tram and trolleybus routes and their timetables. The system will allow passengers to be billed for journeys on a given route based on their identification in various means of transport, but it is not a solution shaping a single ticket tariff, but only a form of payment integrator for public collective transport services.

In the context of the information contained above, the most realistic integration model would be a district-commune Union with obligations in the field of tariff and ticket integration and passenger information, while the most optimal would be a metropolitan Union. Both solutions are most similar to foreign solutions. Taking into account local and national conditions during the preparation of the analysis and the preferences of local government units, the preferred model is the metropolitan union model in the hybrid/light version.

It is worth adding that none of the adopted organisational integration models significantly affect cooperation with commercial carriers, because the existing legal framework does not specify how the cooperation should proceed - it takes place on a voluntary basis. The only change is the number of entities with which a private entrepreneur can cooperate. Organisational integration may lead to the development and organisation of the network

of public utility connections or an increase in the frequency of services. As a result, the private carrier may:

- cancel the transport due to the reduced profitability of the connections,
- try to adapt timetables, routes and ticket prices to new conditions,
- try to contact the Organiser in order to include their connections in the integrated network,
- start participating in tender procedures announced by the Organiser.

The first and third approaches were used by carriers during the COVID-19 pandemic, when there was a significant reduction in transport profitability. This forced private carriers to establish cooperation with local governments in order to obtain additional funds from the Bus Connections Development Fund and maintain the transport offer at that time. It is also worth noting that the operation of integrated Organisers results in a smaller number of commercial connections, especially in areas where GPA and ZTM Warszawa connections operate (see: Map 7.). From the perspective of the organiser, it is worth considering conducting consultations with private carriers in order to reach a consensus with commercial carriers when creating the Metropolitan Transport Plan in terms of the connection network or principles of potential cooperation (e.g. in terms of rolling stock standards).

In the case of new commercial carriers, the authorities issuing permits for regular transport may refuse to issue a permit based on the analysis. The analysis covers routes up to 100 km long extending beyond one district or city with district rights and takes into account, among others, existing communication, including: type of vehicles, their departure times or frequency of courses and their adaptation to social needs.

3.5. RECOMMENDATIONS FOR TARIFF AND TICKET INTEGRATION

In terms of fare and ticket integration, it is recommended that it be adapted to the current and future organisational conditions in the field of public collective transport in the Warsaw Metropolis, because fare and settlement management is the task of transport Organisers. Due to the multitude of Organisers and carriers, full tariff and ticket integration in the MW area will require the establishment of a new unit or the use of inter-commune agreements. The table below presents the links between the organisational integration model and the entity responsible for tariff and ticket integration.

Table 3. The organisational integration model and the entity acting as a tariff and ticket integrator

Integration model	The integrator's duties are performed by:
Inter-commune agreement	The Public Transport Authority in Warsaw, which cooperates with other Organisers on the basis of agreements
Metropolitan Union (full version)	City/Metropolitan Transport Authority
Metropolitan union (hybrid/light version)	The Warsaw Public Transport Authority, which cooperates with other Organisers on the basis of Article 15a of the Act on Public Transport
District/commune Union	District/commune Union
Capital company of local governments	Capital company of local governments

Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

The basic goal of tariff and ticket integration should be to offer the same fares for travel on the same route by different carriers or tickets enabling the use of the ticket when transferring to means of transport of different operators. The best solution would be to offer an integrated ticket enabling travel on all means of transport that perform public utility services. Whenever possible, it is worth trying to include commercial carriers in the joint ticket offer, which, as in the case of organisational integration, cooperate on a voluntary basis. The indicated ticket could be made available via a mobile application or sold in paper form.

An example of inter-commune agreements in the field of ticket tariffs are the special integrated offers of the ticket tariff: **Common Łódź-Zgierz Ticket** and **Common Łódź-Pabianice Ticket**. The solution is aimed at people using public transport within the local public transport in Łódź and the city bus transport in Zgierz or Pabianice, depending on the offer. Both offers are characterised by different

ticket rates and their own catalogue of discounts due to different entitlements to discounted travel within individual cities. The agreements have been in force since 2017 and define the principles of operation of the offer, its distribution, the ticket medium (MIGAWKA card), the method of calculating ticket prices, the division of revenues, the catalogue of discounts, the principles of exchanging information on ticket sales and promotion of the offer.

Equally, on the basis of the inter-commune agreement of the communes with the City of Łódź and the agreement between Łódź, the Łódź Agglomeration Railway (ŁKA) and POLREGIO, the **Common Agglomeration Ticket (WBA)** operates, entitling the holder to use public transport in Łódź, Pabianice, Zgierz, Łask, Zduńska Wola, Sieradz, Stryków, Głowno and Łowicz as well as trains of the Łódź Agglomeration Railway and POLREGIO. The offer is characterised by its own catalogue of discounts due to the functioning of different types of discounts in urban and rail transport. The offer has been in operation since 2014.

Wspólny
Bilet
Aglomeracyjny

3.6. RECOMMENDATIONS ON PASSENGER INFORMATION

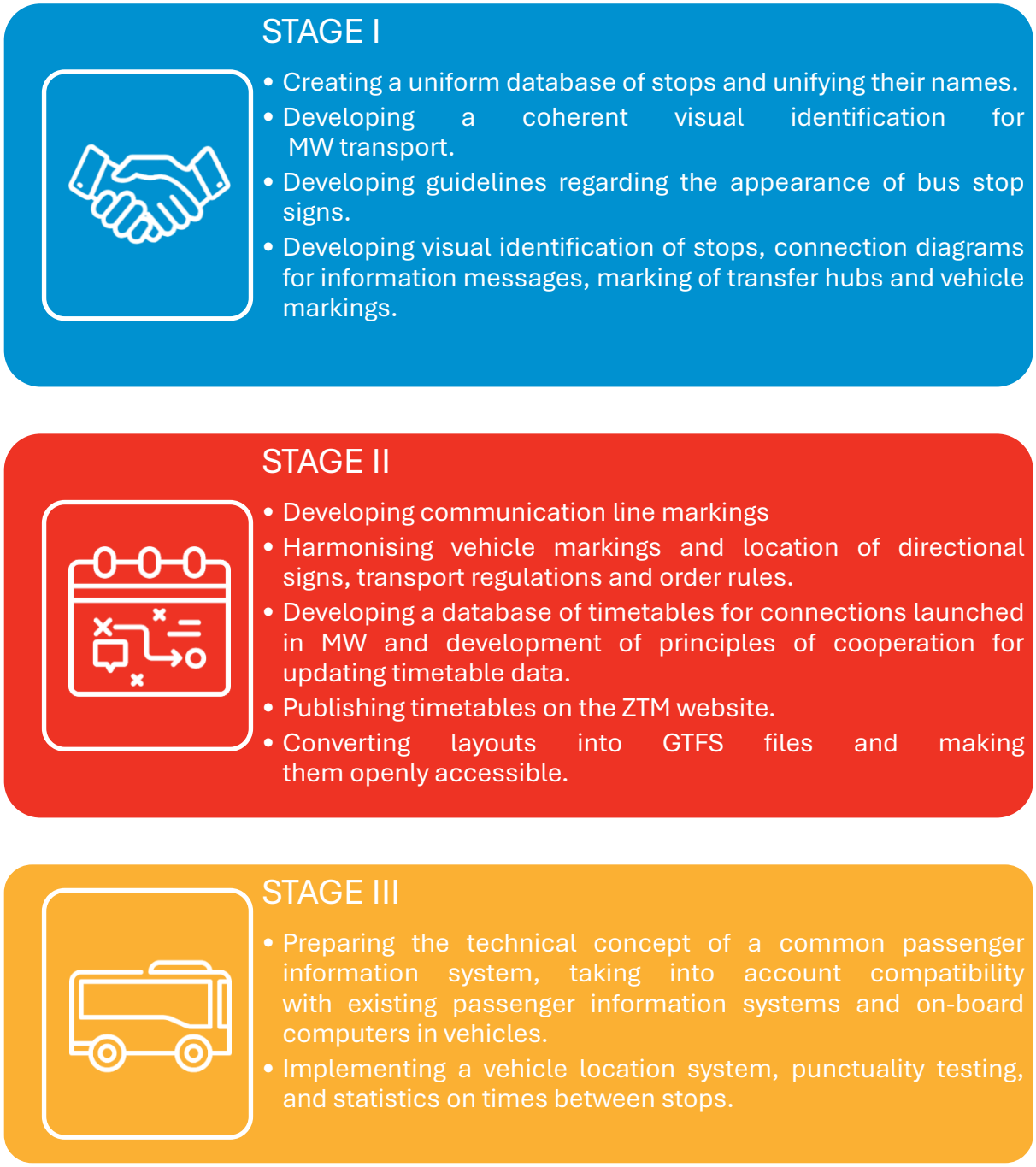
The integration of passenger information could take place using inter-commune agreements with the City of Warsaw or using a newly established unit. First of all, it would be necessary to **standardize the names of stops** in cooperation with road managers and create a database of them, which would be the basis for developing a database of timetables for connections launched in MW. At the same time, it is also worth developing a coherent visual identification for MW transport, which will be understandable and legible for all passengers. Visual identification should include, among others, guidelines regarding the appearance of bus stop signs, visual identification of bus stops, connection diagrams, information messages, marking of transfer hubs and marking of vehicles regardless of the ownership of the rolling stock or affiliation to a given organiser.

The second stage should be to jointly **develop the markings of communication lines**, harmonise the marking of vehicles and the location of directional boards, transport regulations and order rules. At the same time, work may be underway on developing **a database of timetables** for connections launched in MW and developing principles of cooperation for updating timetable data. The result of the work on the digitalization of timetables should be their publication on the ZTM website, as well as the transformation of timetables into GTFS files, which could be made available in free access for later use by commercial online connection search engines. Thanks to this, the passenger will gain information about bus departures for the selected day.

The final stage of passenger information integration could be the preparation of a technical concept for **a common passenger information system**, which would take into account compatibility with existing passenger information systems and in-vehicle computers. Thanks to this, it will be possible to implement a vehicle location system, research on punctuality of journeys and statistics on inter-stop times. The passenger will also receive information about bus departures in real time, as is currently the case in the ZTM Warsaw network.

In the field of passenger information, **cooperation with commercial carriers** is largely voluntary. The cooperation may consist in forwarding the timetable to the organiser of public transport in order to provide the public with information necessary to administer the passenger information system in an appropriate format for the organiser. A bigger challenge may be equipping commercial carriers' vehicles with vehicle tracking systems, which would require appropriate agreements with private entities.

Figure 5 . Passenger information integration stages



Source: Own study of the Economic Advisory Team TOR Sp. z o.o.

4. LIST OF TABLES, CHARTS, MAPS, DRAWINGS AND PHOTOS

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