

FREIGHT TRANSPORT IN THE CITY AND ITS IMPACT ON THE LIVES OF RESIDENTS

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Purpose: Transport has an impact on economic strength, product availability and the quality of life and attractiveness of urban areas. Transport has an impact on economic strength, product availability and the quality of life and attractiveness of urban areas. The aim of the article is to present the importance of freight transport and its nuisance from the point of view of a resident.

Design/methodology/approach: The document contains an analysis of the literature on freight transport in cities. In addition, GUS data on the transport of goods in Poland were analyzed and surveys were conducted in which respondents assessed the impact of goods flows on their quality of life.

Findings: During the literature search, a correlation was found between the transport of goods in the city and the functioning of the inhabitants. It turns out that residents largely generate the flow of goods themselves using on-demand deliveries.

Originality/value The study presents the results of proprietary research addressed to residents in order to learn their opinions about the transport of goods and deliveries carried out in the city. In addition, the article, based on the available statistical data, proves the relationship between the development of the e-commerce industry and the transport of goods in the city.

Keywords: logistic, transportation of goods in the city, Quality of life of city dwellers.

Category of the paper: Research paper.

1. Introduction

Transport is one of the elements that integrate most logistics processes. Transport is of great importance both for the inhabitants of a given area and for local entrepreneurs, which is an inseparable element of the functioning of residents. Transport has an impact on the economic strength, the availability of products and the quality of life and attractiveness of urban areas. Transport has an impact on the economic strength, the availability of products and the quality of life and attractiveness of urban areas (Macharis, 2011). Freight flows in urban areas account for 20-30% of total vehicle-kilometres (Dablanc, 2007). Cities need freight transport, but they

often underestimate its importance (Macharis,2011). The subject of passenger transport is of greater interest from the city authorities, but also scientists, while 25% of carbon dioxide, one - third of nitrogen oxides and 50% of particulate matter that comes from transport are generated by vans and trucks (LET, 2006). The growing requirements of customers in terms of speed and punctuality of deliveries require an efficient forwarding system, the necessary but insufficient condition of which is a fast and synchronized flow of information with the flow of goods and documents (Rogaczewski, 2017). In addition, the time of the COVID-19 pandemic has significantly affected the number of freight transports. Restrictions on the possibility of shopping in the traditional, stationary way have resulted in an increase in online orders and thus will increase the demand for transport services. Therefore, in the city, the most common customer of transport services is a resident of the city, which in recent years has become the most important element of urban logistics, which makes the implementation of tools to improve the quality of life of residents more and more popular. All these aspects have made the opinion of residents in relation to the flow of goods in the city extremely important, which has become the goal of this article.

2. Literature review

2.1. Transport of goods in Poland

Transport enables the exchange of goods and services, which makes it one of the factors determining economic growth. It is acting simultaneously as a provider of transport services and as a recipient of services of, including enterprises producing metals, steel, etc. (Rydzkowski, 2009). In Poland, in order to move goods, mainly two modes of transport are used: road transport, also known as road transport, and rail transport. However, the only transport branch to which all cities in Poland have access is road transport, which is why the article will focus on issues related to road freight transport. Road transport of goods is one of the three largest sectors of the Polish economy, next to wholesale trade and retail trade. The direct share of the transport and storage sector in Polish GDP is 6 per cent, but its importance for the economy is significantly higher. Without transport, other industries could not function – especially trade and industry. According to TLP and SpotData estimates, transport is one of the critical cost items for industries that generate 50 percent of Polish GDP. In the years 2017-2021 (Road transport in Poland 2021+), the number of transported cargo by road transport increased from 1 747 266 thousand tons in 2017 to 1 952 465 thousand tons in 2021 (Table 1). The largest increase compared to the previous year, amounting to over 7%, was recorded in 2018. A slight decrease (0.1%) can be seen in 2020 compared to 2019.

Table 1.
Cargo transport in 2017-2021

	In thousands of tons				
	2017	2018	2019	2020	2021
Road transport	1747266	1873022	1921073	1 919 193	1 952 465
Including commercial	1104209	1183750	1206218	1203395	1203019
Including motor transport companies	867816	920924	926786	928395	949907
Percentage increase/decrease in road transport compared to the previous year	---	7,20%	2,57%	-0,10%	1,73%

Source: Own elaboration based on CSO data.

From the point of view of freight transport, a physical road has no direct value in itself, it is an added value during its use. The main advantage of road transport is, among others, flexibility allowing for quick change of route, delivery address or place of loading. Another important feature is the implementation of transport directly from the place of dispatch, loading to the place of delivery, without the need for reloading or changing the means of transport (Engström, 2016; Leończuk, 2011).

Increasing consumer expectations mean that the transport system of the twenty-first century should be characterized by high flexibility and frequency of deliveries, while maintaining high quality of services and safety of transported goods. An important element is also a short waiting time for delivery and low transport costs. All these features imply the need for constant changes in the transport system. Not without significance is also the development of e-commerce, which contributes to a large number of groupage shipments delivered to city centers. This transport is carried out to the greatest extent with the use of road transport due to the dispersion of consignees and senders in the city. In 2021, compared to 2020, an increase in the transport of many groups of goods was recorded (Table 2), including over 50% more clothing products transported, 7% more food and food products, and 10% more fish and agricultural products. One of the reasons for the growth may be the development of the ecommerce industry caused by the COVID 19 pandemic. In 2021, one ton of cargo was transported over an average distance of 240km.

Table 2.
Increase in transport of selected groups of goods in 2021 compared to the previous year

GROUPS OF GOODS	in thousands	2020 = 100
	Total	1 580 517
Products of agriculture, hunting, and forestry; fish and other fishery products	117 838	110,6
Coal and lignite; crude petroleum and natural gas	34 783	147,9
Metal ores and other mining and quarrying products; peat; uranium and thorium	363 224	102,3
Food products, beverages and tobacco	191 082	107,0

Cont. table 2.

Textiles and textile products; leather and leather products	6 501	150,1
Coke and refined petroleum products	48 196	101,5
Chemicals, chemical products, and man-made fibres; rubber and plastic products; Nuclear Fuel	85 420	111,0
Basic metals, fabricated metal products, except machinery and equipment	88 045	117,5
Machinery and equipment n.e.c.; office machinery and computers; electrical machinery and apparatus n.e.c.; radio, television and communication equipment and apparatus; medical, precision and optical instruments; watches and clocks	30 483	125,5

Source: Goods road transport a by groups of goods in 2021, data provided by the CSO.

An important element affecting transport, both in the logistics system of the city and outside it, is its proper preparation for transport. The method of load formation is important, especially during combined or partial transport. It is important that the transported goods are packed in a way that allows the placement of further loads in order to replenish the transport space of the vehicle. In addition to the dimensions, the weight of the load is also important, which should be evenly distributed on the axles of the vehicle. In the city's logistics system, various types of cargo are transported, both with standard dimensions and requiring the use of specific containers or means of transport. This type of cargo includes food often delivered to recipients in the city. Logistics management of transported cargo is very difficult, not only because of the small amount of data and comparative models, but also because of the complexity of this process. No city is able to completely meet the needs of residents for goods that are imported from outside, most often by vans. Residents' expectations regarding quality, punctuality and flexibility of deliveries are growing. Manufacturers are obliged to deliver smaller quantities more frequently, thus directly contributing to the increased truck traffic in cities, which in turn adversely affects the surrounding environment (Zielińska).

2.2. Intra-city supplies of goods

Depending on the city, its financial and infrastructural capabilities, many systems supporting the management of flows in the city can be distinguished. One of them is Intelligent Transport Systems (ITS), whose task is to increase the efficiency and safety of all road users. The use of ITS tools has a positive impact on reducing the amount of carbon dioxide emissions in cities, shortening travel times, reducing the number of accidents in the city and increasing the capacity of transport networks (Jamroz, 2009). The advantage of modern transport solutions is also the ability to give priority to public transport. Intelligent transport systems cover the entire infrastructure of the city, depending on the access of a given area to airports, sea or rail means of transport. In order to reduce emissions and congestion during rush hour, many cities choose to regulate access to certain parts of the city. Most often this is related to the ban on daily deliveries or limiting the flow of vans during the busiest hours. In such cases, distributors can use the so-called time windows or make a delivery at night. An important issue in the case

of late delivery of goods is the need to comply with the legally sanctioned noise level (Gingerbread, 2016).

Comparing the different parcel delivery systems in the city, it can be seen that only delivery "personally" requires the direct involvement and presence of the customer, which is one of the reasons for the large percentage of undelivered parcels. Table 4 presents various ways of delivering parcels in the city.

Table 3.
Comparison of different delivery options in the city

	Delivery to your own hands	Delivery boxes	Access system	Collection banks	Pick-up point
Contractor of the last kilometer	Supplier	Supplier	Supplier	Client	Client
Customer presence at the pick-up	Yes	no	no	no	No
Product types	Every	Packages/Food	Packages/Food	Packages/Food	Packages/Food
Pick-up time	Pre-appointed	24h	24h	48h	Opening hours of the point
Investment cost Initial	Low	Medium/High	Medium	Medium	Low/Medium
Delivery costs	High	Low	Low	Lowest	Lowest
Potential operational problems	Large percentage non-delivery. Poor utilization of vehicle capacity	Requires a large number of boxes/ Boxes must be collected	Customer anxiety for safety. Necessary Good location Supply.	The customer must come after reception	The customer must come after reception

Source: own elaboration based on: Allen, J., Thorne G., Browne, M. (2007). The solution of the "last kilometer". In: BESTUFS Guide to good practices in urban freight transport, p. 49, http://www.bestufs.net/download/BESTUFS_II/good_practice/Polish_BESTUFS_Guide.pdf, 5.12.2019.

It should be emphasized that potential operational problems occur in any type of delivery. The lowest delivery costs were recorded for delivery to collection points and delivery banks, this is due to the fact that consolidated parcels are delivered to one place of delivery. The disadvantage of personal delivery of products is the need to use small vehicles, which can result in higher operating costs and a more negative impact on the environment than in the case of unconfirmed shipments. The use of banks, boxes and collection points gives you a greater opportunity to plan transportation route and travel schedule. The disadvantage is the limited size of the box and the generation of traffic at the pick-up point. Each of these methods of parcel delivery and intelligent traffic control systems to a greater or lesser extent affect the functioning of the city's logistics system.

3. Research methodology

The research tool used to conduct research among residents of cities, communes and poviats was a structured questionnaire. The research was carried out using electronic communication channels (CAWI technique – Computer Assisted Web Interview), therefore it was not possible to estimate the level of reflexivity of the questionnaire. The identified number of visits to the page containing the questionnaire was 623, of which 387 (62.1%) were obtained, including 386 full, correctly completed questionnaires and 236 (37.9%) impressions, visits, without completing the questionnaire¹.

The survey contained 28 questions of various nature: open, closed with the possibility of single and multiple choice, with nominal ranges and using the Likert scale. The survey included optional questions, assuming that not every respondent has sufficient knowledge to answer them. Below are presented the results of research on questions on the impact of freight transport on the quality of life in the city from the perspective of a resident.

4. Results

386 people took part in the survey, including 183 (47.4%) women and 203 (52.6%) men. The vast majority of respondents had secondary or higher education – a total of 75.9%. In addition, 100 (25.9%) of respondents were under 30 years old, 128 (33.2%) between 30-40 years old, 123 (31.9%) between 40-50 years of age, and 35 (9.1%) respondents over 50 years of age. This distribution of the age structure is largely due to the fact that the research uses an electronic form sent out using social networking sites and e-mail, which most people over 50 use to a minimal extent (Kuchta-Nykiel, 2018).

A significant part of respondents (as many as 61.4%) indicates the city center as their place of residence (52.1%) or the very center of the city in the vicinity of the pedestrian zone, market square (9.3%) The answers to the questions resulted from the observations and experiences of the respondents, and not from their personal participation in the deliveries. The aim of the study was to determine the burdensomeness of the deliveries from the point of view of residents. 60.1% of respondents declared that their place of residence is no more than 300m from the nearest company. 57.8% of respondents answered in the affirmative to the question whether in their opinion the delivery of goods in the city is burdensome for residents. From the analysis, it can be concluded that the value of burdensomeness of supply-related factors for respondents living up to 500 m from the service/commercial/production point is approx. 60%. For people

¹ The research was conducted 179 days from 14 January 2020 to 10.07.2020.

whose place of residence is more than 500 m from the undertaking, the burdensomeness of deliveries is approx. 24% (Fig. 1).

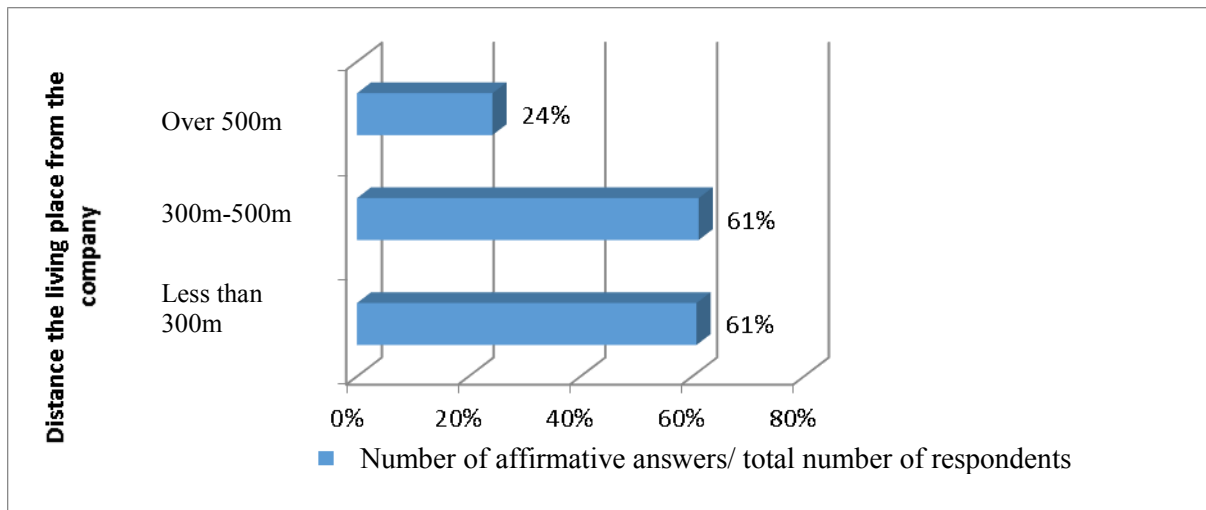


Figure 1. Ratio of the burdensome deliveries at service points to the number of responses about the distance of the undertaking from the place of residence.

Source: own elaboration based on empirical research.

Based on the literature review, 6 factors were identified that may be negatively perceived by residents. Respondents could indicate any number of answers. The research shows that the most common difficulties and factors negatively perceived by residents related to the delivery/unloading of goods are (Fig. 2):

- Difficulties related to blocking the road by a delivery vehicle – 74.1%.
- Delivery time – 46.7%.

Leaving the van at hazard lights in the middle of the lane, the lack of unloading places at retail and service outlets and blocking sidewalks is a common problem not only in large cities, but also in suburban areas, which is probably why this problem was indicated as the most burdensome factor. Other factors were assessed below 50% share. The least troublesome factor was the loud sound of the engine running (17 people (6.6%) marked this answer).

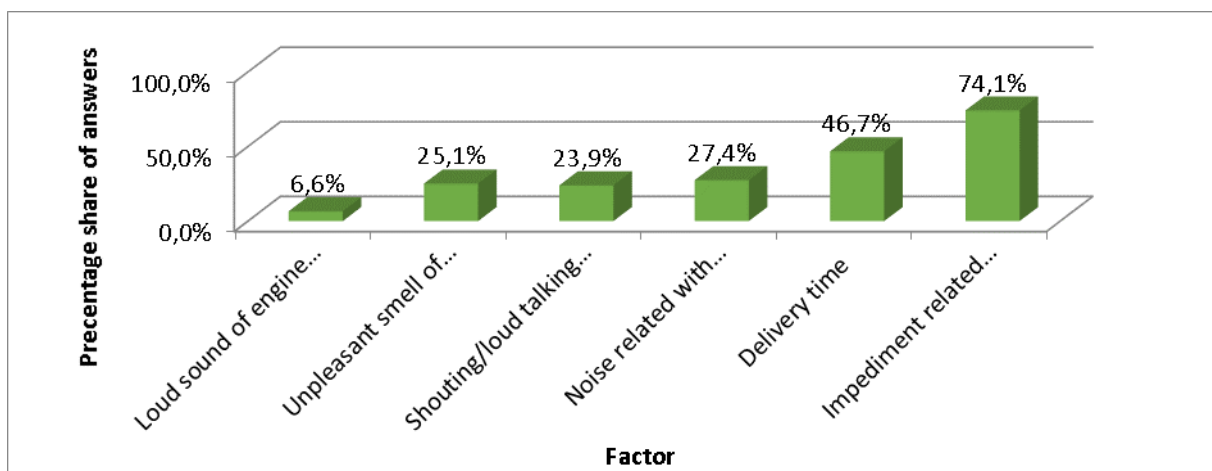


Figure 2. Factors negatively perceived by residents, occurring during delivery.

Source: own elaboration based on empirical research.

In recent years, online shopping with direct home delivery has become increasingly popular, with an estimated 600 million more people living in urban environments by 2030, exacerbating the problem of managing last-mile flows. Single loads are distributed along the route with several stops. These routes change depending on weather conditions, dispersion of pick-up points, traffic and many other factors. In the next question, the question was asked about the use of deliveries carried out directly to the home or collection point at the individual request of the resident. It turns out that 332 people (86%) use this type of delivery, only 54 respondents (14%) denied²³ (Fig. 3).

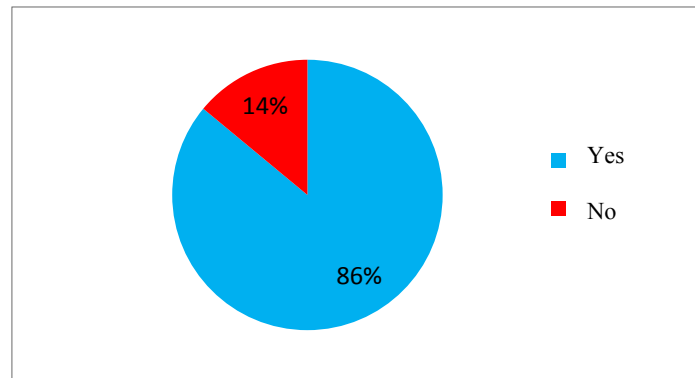


Figure 3. Use of online orders with individual delivery.

Source: Own elaboration based on conducted research.

Most of those declaring the use of individual delivery, 55.42%, indicated that they most often order products purchased online and through online auctions with home delivery (Fig. 4).

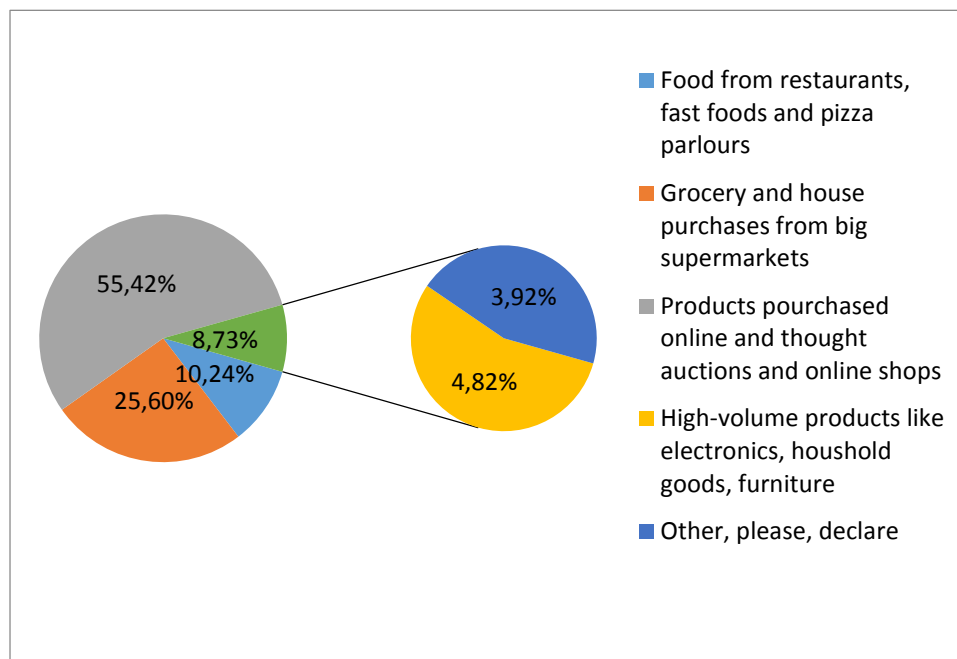


Figure 4. Most often ordered by residents for products with home delivery.

Source: own elaboration based on empirical research.

² <https://www.mhlnews.com/transportation-distribution/article/22055353/how-to-solve-the-last-mile-problem>.

³ <https://www.dfds.com/en/about/insights/newsletters/3-solutions-to-the-last-mile-transportation-problem>.

Grocery and household purchases from large-format stores with home delivery are very popular (25.6%).

On the basis of literature research, 13 factors related to the flow of goods and affecting the lives of residents were collected. Each of the respondents had the opportunity to evaluate them. The results of the conducted research and the list of factors are presented in Table 4.

Table 4.
Factors affecting the lives of residents

Answer	No impact(%)	Little impact(%)	Medium impact(%)	Huge impact(%)	Very big impact(%)
Noise level	2,6	13	19,2	58,3	7
Air pollution level	1,3	10,6	33,4	34,7	19,9
Air pollution level with other chemicals	3,9	15,3	30,6	38,6	11,7
The rate of smog formation in the city	2,1	14	29,3	36,3	18,4
The level of dirt in the city (under the influence of dust rising)	1,6	13,7	29,5	37,8	17,4
Safety of residents on sidewalks and pedestrian streets	3,9	14,2	25,6	36	20,2
Number of traffic accidents in the city	4,7	19,2	28,8	30,8	16,6
Incidence of congestion	3,9	11,9	28,2	39,4	16,6
Building new receiving-transmitting points	3,1	13,2	26,7	38,3	18,7
Access to goods and services	1,8	7,8	22,8	46,6	21
Numer of service and commercial points	1,8	8,3	30,6	41,2	18,1
Speed of delivery of individual courier parcels	1,6	6,5	23,6	48,7	19,7
Supply for catering outlets	1,3	7,8	24,4	42,7	23,8

Source: own elaboration based on empirical research.

Taking into account the obtained results, it can be concluded that the noise intensity of goods flows has a great impact on the lives of residents (58.3%). More than 2/3 of respondents (68.1%) believed that the level of air pollution with carbon dioxide has a medium or large impact on existence. Freight transport is important for the speed of smog formation in the city and the number of traffic accidents. The respondents considered that the flow of goods has a significant impact on the speed of courier delivery (48.7%) and the availability of goods and services (46.6%). The results of Table 22 show the great importance of freight flows to all spheres of life in the city, directly and indirectly involving residents. In order to check which of the factors is the most important for the respondents, another attempt was made to calibrate the results and the average of the grades of each element was determined, assuming that -2 means no impact and 2 a large impact. The results of the research are presented in Table 5.

Table 5.*Average for factors affecting the standard of living of residents*

Factor	Average	Factor	Average
Noise level	0,54	Number of traffic accidents in the city	0,35
CO2 air pollution level	0,61	Prevalence of congestion	0,53
Air pollution level with other chemicals	0,39	Building new receiving and sending points	0,56
The speed of smog formation in the city	0,55	Availability of goods and services	0,77
Level of dirt in the city (under the influence of floating dust)	0,56	Number of service and commercial outlets	0,66
Safety of residents on sidewalks and pedestrian streets	0,54	Speed of delivery of individual courier shipments	0,78
Supply of catering outlets	0,80		

Source: own elaboration based on empirical research.

The results presented in Table 16 show that all the presented factors are characterized by a similar degree of importance for the respondents. The highest average was obtained by such factors as:

- supply of catering outlets (average 0.80),
- speed of delivery of individual courier parcels (average (0.78),
- accessibility to goods and services (average 0.77).

The lowest average of 0.35 under the presented assumptions was obtained by the number of traffic accidents in the city.

5. Conclusions

Transport is one of the most important elements of the city's logistics. It contributes to many phenomena occurring in the city: positive and negative. Freight transport in the city plays a very important role, not only for businesses, but above all for the residents themselves. Research has shown that over 80% of respondents declare using online orders, thus generating an increased flow of goods in the city. From the residents' point of view, the most burdensome is blocking the road by the delivery car. The results of the survey addressed to residents show that the flow of goods in the city affects many elements of residents' lives, including the availability of goods and services, the number of traffic accidents in the city, the level of air pollution. Therefore, it would be necessary to look for solutions that will not only improve the flow of goods in cities, but also improve the quality of life of residents.

References

1. Allen, J., Thorne, G., Browne, M. (2007). The solution of the "last kilometer". In: *BESTUFS Guide to good practices in urban freight transport*, p. 49, http://www.bestufs.net/download/BESTUFS_II/good_practice/Polish_BESTUFS_Guide.pdf, 5.12.2019.
2. Dablan, L. (2007). Goods transport in large European cities: difficult to organize, difficult is modernize. *Transportation Research Part A: Policy and Practice*, 41(3), pp. 280-285.
3. Engström, R. (2016). The roads' role in the freight transport system. *Transportation Research Procedia*, vol. 14, p. 1447.
4. Gingerbread, D. (2016). *Distribution of goods in urban logistics*, <https://samochody-specjalne.pl/2016/09/30/dystrybucja-towarow-w-urban-logistics/3/>, 4.12.2019.
5. Jamroz, K., Oskarbski, J. (2009). Intelligent transport system for Tri-City agglomeration. *Telecommunications and Information Technologies*, No. 1-2, p. 66.
6. Kuchta-Nykiel, M. (2018). *Social media in Poland – who uses social networking sites?* Socialpress, <https://socialpress.pl/2018/06/social-media-w-polsce-kto-korzysta-z-serwisow-spolesznosciowych>, 11.07.2020.
7. Leończuk, D. (2011). Transport Road Goods in Poland. *Economy and Management*, No. 4, p. 99.
8. Let, et al. (2006). *Méthodologie pour un Bilan (disambiguation environnemental physique du transport de marchandises)*. En Ville, Paris: ADEME/Ministère des Transports, p. 37.
9. Macharis, C. (2011). The Problem Situation and Possible Solutions. In: *City distribution and Urban freight transport: Multiple perspectives*, p. 13.
10. Macharis, C., Melo, S. (2011). Introduction – city distribution: challenges for cities and researchers. In: *City distribution and Urban freight transport: Multiple perspectives*, p. 1.
11. Report "Road transport in Poland 2021+" - production of half of Polish GDP dependent on road transport, <https://tlp.org.pl/raport-transport-drogowy-w-polsce-2021/>, 5.10.2022.
12. Rogaczewski, R., Zimniewicz, S., Zimny, A. (eds.). (2017). *Transport and logistics in the enterprise, city and region. Selected issues*. Katowice
13. Rydzkowski, W., Wojewódzka-Król, K. (eds.), (2009). *Transport*. Warsaw: PWN, p. 1.
14. Zielinska, L. *Challenges in managing urban cargo transport logistics*, https://wilis.pg.edu.pl/documents/2336321/48297385/Zieli%C5%84ska_Lidia_Wyzwania_w_zarz%C4%85dzaniu_miejsk%C4%85_logistyki%C4%85_transportu_%C5%82adunk%C3%B3w.pdf, 31.07.2019.