Scientific Journal of Silesian University of Technology. Series Transport

Zeszyty Naukowe Politechniki Śląskiej. Seria Transport



p-ISSN: 0209-3324

Volume 127

e-ISSN: 2450-1549

DOI: https://doi.org/10.20858/sjsutst.2025.127.17



2025

Silesian University of Technology

Journal homepage: http://sjsutst.polsl.pl

Article citation information:

Wołek, M., Hebel, K., Birr, K., Nozari, H. The importance of punctuality in particular segments of public transport users: a case study from Gdynia (Poland). *Scientific Journal of Silesian University of Technology. Series Transport.* 2025, **127**, 277-289. ISSN: 0209-3324. DOI: https://doi.org/10.20858/sjsutst.2025.127.17

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THE IMPORTANCE OF PUNCTUALITY IN PARTICULAR SEGMENTS OF PUBLIC TRANSPORT USERS: A CASE STUDY FROM GDYNIA (POLAND)

Summary. Increasing the share of trips using public transport is a long-term activity that necessitates continuous improvement of the offer. What is crucial here is not only the tangible sphere, measured by objective indicators of punctuality, but also the subjective area of passenger feelings and assessments. The latter is significantly influenced by punctuality, which can be the catalyst for a long-term process of strengthening passenger loyalty and enhancing the public transport experience. The article aims to assess the importance of punctuality against the background of other transport requirements in the opinion of all city residents, with particular emphasis on the views of people using public transport to varying degrees. Research carried out in Gdynia (Poland) showed that punctuality is one of the most important parameters through which residents evaluate the functioning of public transport, regardless of the method of urban travel. Punctuality is of the greatest importance for people who always travel by car and usually by bicycle.

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Punctuality is the second most important transport requirement for people who always and usually travel by public transport, i.e., the most important segment of public transport users. The research results confirm the high significance of punctuality among residents, irrespective of their mode of urban travel. Punctuality, though just one of the many aspects of the quality of transport services, plays a pivotal role in shaping the overall opinion about the transport system.

Keywords: public transport, punctuality, case study in public transport

1. INTRODUCTION

Transport, among water and energy, remains the core system of the resilient city (World Bank Group, 2018). Public transportation is one of the fundamental subsystems of a city's functioning. It is independent of meteorological conditions, ensuring a constant supply level with similar quality parameters throughout the year. However, it is struggling with the growing pressure from individual motorisation, which is an inherent feature of urban development processes (Boarnet & Crane, 2001; European Environmental Agency, 2006; Mouratidis et al., 2019). The high share of individual car transport in urban travel brings with it several traffic-related problems (Altarifi & et. al, 2023; Garrido-Valenzuela & et al., 2022; Goswami & Tripathi, 2019; Wołek & Jagiełło, 2017) environmental-related (Corazza et al., 2016; Garrido-Cumbrera et al., 2023; Goswami & Tripathi, 2019; Kalbar et al., 2018; Okraszewska et al., 2018; Perveen & et. al., 2020; Wołek & Jagiełło, 2017; Zhang et al., 2023) and health-related challenges (Ikeda et al., 2019; Levy et al., 2010; Lozzi & Monachino, 2021).

Hence, for many years, the pillar of planning sustainable urban mobility has been building an attractive public transport offer, the quality of which will encourage the use and change of modal split. To shape an attractive public transport offer, you need to understand how users assess the quality of public transport services. One of the most important features of a public transport service is punctuality. Its meaning is multi-faceted, as it includes:

- passenger's perspective through the prism of punctuality (or lack thereof), the attractiveness of public transport is assessed, which translates into satisfaction and, ultimately, into loyalty and determines the way urban travel is carried out;
- operator's perspective lack of punctuality means an increase in expenses for implementing the assumed timetable (increase in the number of vehicle hours and the number of vehicles);
- transport authority/public authority's perspective punctuality is an element of the service contract.

The article aims to assess the importance of punctuality in relation to other transport requirements, as perceived by all city residents, with a particular emphasis on the views of public transport users. This research is particularly relevant to transport planners, public transport operators, and urban policymakers, as it provides insights into the factors that influence user satisfaction. Therefore, marketing research results on the transport behaviour and preferences of Gdynia (Poland) inhabitants were used. To achieve the research goal, the following research questions were asked:

RQ 1: What is the place of punctuality in assessing urban transport users compared to other transport features?

RQ 2: Does the importance of punctuality vary depending on the scope of public transport use for urban travel?

2. LITERATURE REVIEW

Punctuality, a determinant of service quality, denotes the extent to which the planned departure and arrival times of urban transport vehicles are fulfilled in the scheduled timetable. It is a fundamental aspect of service quality, a basic specification of the service quality being described, and a straightforward criterion for measuring the quality of urban transport services. Punctuality can be divided into:

- objective punctuality as the measured deviation between the times specified in the timetable and the times achieved,
- subjective punctuality perceived by the passenger by comparing known target timetable values (departure times, arrival times) with absolute values (Zych-Lewandowska & Dobrzycka, 2017).

Real-time timetables, accessible via a mobile website or QR code at stops, and dynamic passenger information boards at public transport stops can positively influence subjective punctuality.

Passengers show varying sensitivity to deviations from the arrival of public transport from the timetable, namely (Kędzior R., 2015):

- premature departures of public transport vehicles are perceived as particularly unfavorable and should be strictly avoided,
- early arrivals are not perceived negatively,
- public transport users notice delayed departures and are evident in the absence of information about the delay,
- delays are of great importance to the passenger, especially when the means of transport is late at the transfer hub, and there is a very high risk that the passenger may miss the next connection,
- both premature departures and delayed connections are particularly unfavourable to passengers who make mandatory trips.

2.1. Quality of public transport service

The quality of public transportation services is influenced by many objective and subjective factors. Moreover, as research shows, the determinants influencing the quality assessment depend not only on the individual characteristics of the passenger but also on the geographical region over long periods (Abenoza et al., 2017) and the size and type of the urban area. For example, in studies conducted in Italy, the highest share of people satisfied with public transport services (70%) was characteristic of residents of small cities; in the case of larger municipalities, this percentage dropped to approximately 60% and to just over 40% in metropolitan areas (Diana, 2012). "Overall level of passenger satisfaction is best measured by how an individual evaluates the total package of services offered" (Hensher et al., 2003).

The quality of public transport services is assessed by meeting its individual features. From the user's point of view, these features may have different meanings; therefore, it is essential to examine their significance. Much empirical research and theoretical arguments have been devoted to establishing the list of features. Although most of the identifications overlap to a large extent, some discrepancies can be observed between them. They concern:

- combining specific postulates into one synthetic one;
- omitting particular demands as less important;
- taking into account rare or even specific demands.

2.2. Punctuality as a public transport attribute

The punctuality of public transport is one of the most critical parameters through which the service is assessed (Eboli & Mazzulla, 2018). Some of the studies devoted to the issue of the quality of public transport services equate the concepts of "punctuality" and "reliability" (Monchambert & de Palma, 2014; Redman & et. al. 2013). The latter, based on a qualitative systematic review, divided the features of the public transport service into two groups: "physical" and "perceived" (Fig. 1). The physical features include, among others, reliability (understood as punctuality), speed, frequency, and price. In a study in five European capitals (Madrid, Lisbon, Berlin, Rome, and London), passenger car users identified frequency, punctuality, intermodality, cost, and cleanliness as the most important features of public transport (de Ona et al., 2021). Another study conducted in the Indian city of Bhopal revealed that the most important attributes of public transport services included reliability (broadly understood and also including punctuality), comfort, safety, accessibility, information, and customer service (Tanwar & Agarwal, 2024). Based on the research results from Los Angeles, Chakrabarti included punctuality (along with travel time and frequency) among the most essential features of the public transport offer that determine its choice. (Chakrabarti, 2017). Other studies also confirmed that punctuality was among the most critical factors associated with the satisfaction of public transport users (van Lierop et al., 2018).

Based on secondary data (Tavares et al., 2021) showed that significant differences in assessing particular groups of attributes occur in different age cohorts of public transport passengers.

Regardless of the research methodology adopted, punctuality significantly determines the perception of public transport services. The quality of the service affects customer satisfaction, which in turn is the foundation for shaping customer loyalty (Esmailpour & et al., 2022) (Fig. 1), influencing the customer retention level (Abenoza et al., 2017). However, the subjective assessment of public transport users should not be equated with the objective features of the transport system. A high level of satisfaction does not necessarily mean an objectively "higher" quality of service and vice versa, as satisfaction is a relative concept and not a measure of absolute success in public transport (Friman & Fellesson, 2009).

To summarise the literature review, travel satisfaction with public transport is defined as the overall fulfilment of travellers' expectations. Punctuality is one of the most important parameters contributing to a passenger's perception of public transport services. It is often equated with the concept of 'reliability.'

3. DATA AND METHODS

3.1. Case study and site description

Gdynia is a young city (city rights granted in 1926) located on the Baltic Sea. Its creation and development are related to the construction of a seaport in the area of a former fishing village. This chronology of events led to the formation of the city around the seaport, with consequences for the transport system that are still visible today. Gdynia is part of the Gdańsk-Gdynia-Sopot Metropolitan Area, which includes 51 communes and eight poviats, being one of the most significant metropolitan areas in Poland and the Baltic Sea Region.

Table 1 includes primary data about the city. High rate of motorisation index is a general trend that can be observed in all Polish mid-size and large cities.



Fig. 1. From service quality to customer loyalty in public transport Source: Self-study based on (de Ona et al., 2021; Esmailpour & et al., 2022; Parasuraman et al., 1985; Redman & et. al, 2013; Tyrinopoulos & Antoniou, 2008)

Main characteristics of Gdynia city (Poland)

Tab. 1

Feature	Unit	Year	Value	
Population	inhabitants	2022	241 189	
Population change	%	2022 to 2010	-2,6	
Density	inhabitants / sq. km	2022	1799	
Share of population in post- working age	%	2022	26%	
Rate of unemployment	%	2022	2,0	
Rate of unemployment	Poland = 100	2022	38,5	
Carbon footprint per capita	tonnes of CO2e / inhabitant	2020	4,89	
Share of forests in the total area of the city	%	2020	46	
Motorisation index	individual cars / 1000 inhab.	2022	682	
Public transport density	vehicle-km of public transport per capita	2022	68	
Public transport passengers	million	2022	67	
Punctuality index of public transport	%	2022	66	

Source: self-study based on (City of Gdynia, 2022)

The public transport system is well-developed. It consists of two subsystems, i.e., railway (managed by the regional government) and urban, managed by the municipal government and represented by the Public Transport Authority. Buses (including electric and CNG) and trolleybuses supply urban transport (Wołek et al., 2020; Wołek & Hebel, 2020). The city's band-island functional system (City of Gdynia, 2019) is affected by the high level of individual motorisation, the development of the port and logistics sector, and neighbouring communes, causing road congestion in the primary transport system. Congestion accumulates during the morning and afternoon rush hours on critical sections of the road network.

3.2. Data

In the methodology for examining the quality of public transport and its components, two approaches can be distinguished, namely:

- based on a direct inquiry from the respondent (customer satisfaction survey) (Eboli & Mazzulla, 2009; Grzelec, 2024; Hebel & Wyszomirski, 2016);
- based on modelling to detect the contribution of each attribute influencing overall passenger satisfaction (Abenoza 2017) (Sukhov & et al., 2021; Tavares et al., 2021).

To verify the research questions posed in the article, the results of marketing research conducted with the participation of the authors by the Department of the Transport Market of the University of Gdańsk and the Municipal Transport Authority in Gdynia in 2010, 2013, 2015 and 2018 were used on a sample of 1% of residents aged 16-75. The sample size of each study was approximately 2,000 respondents. The research was conducted through individual interviews in households, using a survey questionnaire specifically developed for the needs of this study. In total, results from 4 research rounds were used. The research sample was random and obtained through stratified sampling. When distinguishing and building layers, the city districts and the demographics of the inhabitants, including their gender and age, were taken into account. The primary characteristics of the research sample are presented in Table 2.

Tab. 2

Category	Result				
Gender	Female 52,9%; male 47,1%				
Age	Under 20 years 4,9%; 21-30 years 13,7%; 31-40 years 21%; 41-50 years 18,4%; 51-60 years 15,5%; 61-70 years 20,5%, 71-75 years 6%				
Car in the household	Yes 75,5%; no 24,5%				
Bike in the household (excluding bikes for children)	Yes 60,3%, no 39,7%				
Socio-economic status	Work professionally 57,9%; work professionally and studying 2,1%; studying 5,8%; retired 21,9%; not working 7,4%; retired and working 1,5%, others 3,4%.				

Sample characteristics (n=1837)

Modal split	Car 48,9%; public transport 37,1%; walking (trips above 500 m) 11,4%; cycling 2,1%.				
Trip motivation	Home 45,4%, work 25,8%, shopping 9,2%, personal matters 8,2%, education 3,3%.				

Source: self-study based on (ZKM Gdynia, 2019)

4. RESULTS AND DISCUSSION

This subsection comprises two parts that address the respective research questions.

4.1. What is the place of punctuality in assessing urban transport users compared to other transport demands?

Since 2000, punctuality has consistently ranked among the highest in evaluating individual public transport features among Gdynia citizens (Table 3). Since 2006, it has been the second most important parameter (after direct travel, i.e. no need to change trains). Generally, Gdynia's residents considered directness, punctuality, frequency and accessibility the most essential features of public transport services. The first four are features strongly associated with travel time. The conclusions are pretty consistent with the aforementioned study (Chakrabarti, 2017).

Tab. 3

Hierarchy of individual characteristics of public transport in light of the results of marketing research conducted among Gdynia residents from 2000 to 2018

DT attribute	Place in the passengers' hierarchy in a given year									
P I auridule	2000	2002	2004	2006	2008	2010	2013	2015	2018	
directness	4	4	1	1	1	1	1	1	1	
frequency	3	3	2	3	3	4	2/3*	3	3	
accessibility	2	1	4	4	4	3	4	4	4	
information	10	10	10	10	10	10	10	10	10	
cost	5	5	5	6	6	5	5	5	5	
reliability	7	7	6	8	8	6	6	6	7	
speed	8	8	7	7	5	7	7	7	6	
punctuality	1	2	3	2	2	2	2/3*	2	2	
rhythmicity	9	9	9	9	9	9	9	9	9	
comfort	6	6	8	8	7	8	8	8	8	

Source: (Hebel K & Wyszomirski, 2016; Grzelec et al., 2020)

4.2. Does the importance of punctuality vary depending on the level of public transport use for urban travel?

Public transport users are not homogeneous. They can be divided into relatively homogeneous groups based on multiple criteria (Olivieri & Fageda, 2021; Tyrinopoulos & Antoniou, 2008).

This passenger segmentation is based on a generalised travel pattern, described by the answer to the question, "How do you conduct your urban travel?" The response category included seven options, and the distribution of responses is shown in Figure 2. This approach is not fully compatible with a more precise method of travel analysis, as expressed through the so-called "picture of the previous day", which serves as the basis for calculating the modal split. However, it allows for a simplified segmentation of respondents.



Fig. 2. The way of urban travel in Gdynia in 2018 Source: self-study based on (ZKM Gdynia, 2019)

Table 4 indicates the three most important features of the public transport service depending on the method of urban travel in Gdynia. Results from one round of research (2018) are cited to clarify the analysis. Only the segment of people declaring the method of travel as "other" was omitted.

Punctuality is of the utmost importance for people who always travel by car and usually by bicycle. Punctuality is the second most important transport requirement for people who frequently travel by public transport, which is currently the most crucial segment of public transport users. However, the third priority in the hierarchy of transport requirements is for people travelling mainly by passenger car, as well as those travelling equally by public transport and passenger car.

The differences in the importance of punctuality depending on the declared method of travel are not very visible. Still, punctuality is the second most crucial transport requirement for people who use public transport more frequently. People who use a passenger car more often do so because punctuality is most important to them. They believe that travelling by car will provide it more than public transport.

This is confirmed by the data in Table 5, which compares the importance of punctuality for the main users of passenger cars and other individuals who use the car as a passenger. For both groups, punctuality is the second most crucial transport requirement.

Tab. 4

The three most important public transport attributes divided into segments in 2018

Most	Second most	Third most
important	important	important
attribute	attribute	attribute
Frequency	Punctuality	Directness
Frequency	Punctuality	Directness
Frequency	Directness	Punctuality
Frequency	Directness	Punctuality
Punctuality	Frequency	Accessibility
Punctuality	Frequency	Directness
	Most important attribute Frequency Frequency Frequency Punctuality Punctuality	MostSecond mostimportantimportantattributeattributeFrequencyPunctualityFrequencyDirectnessFrequencyDirectnessFrequencyDirectnessPunctualityFrequencyPunctualityFrequencyPunctualityFrequency

Source: self-study based on (ZKM Gdynia, 2019)

Tab. 5

The hierarchy of transport demands depending on access to a personal car among the residents of Gdynia in light of the results of marketing research from 2018

Access to car	directness	frequency	accessibility	information	cost	reliability	speed	punctuality	rhythmicity	comfort
main car users	1	3	5	10	6	7	4	2	9	8
other car users	1	3	4	9/10	5	7	6	2	9/10	8

Source: self-study based on (ZKM Gdynia, 2019)

5. CONCLUSIONS

The sustainable mobility paradigm determines the priority in planning and developing transport systems, especially in urbanized areas (Hickman et al., 2013). It means, among others, maintaining or increasing the role of public transport in everyday transport, especially mandatory transport (Grzelec et al., 2020). Increasing the share of trips using public transport concerning individual transport is complex and requires meeting many parameters to convince residents to use public transport. In this case, the objective dimension of public transport service (measured by various objective indicators, such as the punctuality rate) and the passenger's assessment, based on their subjective feelings, are essential. The latter is significantly influenced by, among other factors, punctuality, which can serve as the starting point for a long-term process of strengthening passenger loyalty. Punctuality, in the opinion of Gdynia's residents, is one of the most critical transport demands; therefore, the transport offer should be designed to ensure punctual departures of vehicles to the maximum extent possible.

Punctuality is an element of the passengers' perceived transportation system reliability. It is directly related to the ability to organise individual journeys, especially those involving multiple transfers, with confidence that they can be completed. The research results indicate that regular disruptions in punctuality, and thus the perceived increase in service unreliability, are significant factors, alongside travel time, influencing the choice of transportation mode for daily commutes.

In addition, providing passengers with accurate information, including the location of a given vehicle or the estimated time of arrival at the stop, and constantly updating the data reduces the feeling of uncertainty and, consequently, increases the attractiveness of public transport. Parallel activities aimed at minimising the share of travel by individual transport and giving priority and many privileges to alternative means of transport to car transport will reduce traffic congestion and improve the driving time and punctuality of public transport vehicles. In the long term, an improvement in the quality of life in the city can be expected, thanks to reduced emissions, noise and improved road safety.

Planners face the challenge of developing a public transportation system while simultaneously maintaining high levels of punctuality and directness of connections, as residents consider these two factors to be the most important in evaluating the system.

References

- 1. Abenoza R., O. Cats, Y.O. Susilo. 2017. "Travel satisfaction with public transport: Determinants, user classes, regional disparities and their evolution". *Transportation Research Part A* 95. DOI: 10.1016/j.tra.2016.11.011.
- Altarifi F., et. al. 2023. "User Preference Analysis for an Integrated System of BRT and on-demand mob services in Amman, Jordan". *Urban Science* 7(4): 111. DOI: 10.3390/urbansci7040111.
- 3. Boarnet M.G., R. Crane. 2001. *Travel by Design. The Influence of Urban Form on Travel.* Oxford University Press.
- Chakrabarti S. 2017. "How can public transit get people out of their cars? An analysis of transit mode choice for commute trips in Los Angeles". *Transport Policy* 54. DOI: 10.1016/j.tranpol.2016.11.005.
- 5. City of Gdynia. 2019. Studium uwarunkowań i kierunków zagospodarowania przestrzennego Gdyni. [In Polish: Spatial masterplan of the city of Gdynia].
- City of Gdynia. 2022. Raport o stanie miasta Gdyni. [In Polish: A Report on the state of the city of Gdynia]. Report. Gdynia City Office. Available at: https://bip.um.gdynia.pl/ogloszenia-urzedu-miasta,2206/raport-o-stanie-gminy-miastagdyni-w-roku-2022,585850.
- 7. Corazza M.V., U. Guida, A. Musso, M. Tozzi. 2016. "A European vision for more environmentally friendly buses". *Transportation Research Part D: Transport and Environment* 45: 48-63. DOI: 10.1016/j.trd.2015.04.001.
- 8. de Ona J., E. Estevez, R. de Ona. 2021. "How does private vehicle users perceive the public transport service quality in large metropolitan areas? A European comparison". *Transport Policy* 112. DOI: 10.1016/j.tranpol.2021.08.005.
- 9. Diana M. 2012. "Measuring the satisfaction of multimodal travelers for local transit services in different urban contexts". *Transportation Research Part A* 46. DOI: 10.1016/j.tra.2011.09.018.

- Eboli L., G. Mazzulla. 2009. "A new customer satisfaction index for evaluating transit service quality". *Journal of Public Transportation* 12(3): 21-37. DOI: 10.5038/2375-0901.12.3.2.
- 11. Eboli L., G. Mazzulla. 2018. "A methodology for evaluating transit service quality based on subjective and objective measures from the passenger's point of view". *Transport Policy* 18(1). DOI: 10.1016/j.tranpol.2010.07.007.
- 12. Esmailpour J., et. al. 2022. "Has COVID-19 changed our loyalty towards public transport? Understanding the moderating role of the pandemic in the relationship between service quality, customer satisfaction and loyalty". *Transportation Research Part A* 162. DOI: 10.1016/j.tra.2022.05.023.
- 13. European Environmental Agency. 2006. Urban sprawl in Europe The ignored challenge. In: Urban Sprawl in Europe: Landscapes, Land-Use Change & Policy (Issue 10).
- Friman M., M. Fellesson. 2009. "Service Supply and Customer Satisfaction with Public Transport: A Quality Paradox". *Journal of Public Transportation* 12(4). DOI: 10.5038/2375-0901.12.4.4.
- Garrido-Cumbrera M., O. Braçe, D. Gálvez-Ruiz, E. López-Lara, J. Correa-Fernández. 2023. "Can the mode, time, and expense of commuting to work affect our mental health?" *Transportation Research Interdisciplinary Perspectives* 21. DOI: 10.1016/j.trip.2023.100850.
- 16. Garrido-Valenzuela F., et al. 2022. "Identifying and visualizing operational bottlenecks and Quick win opportunities for improving bus performance in public transport systems". *Transportation Research Part A* 164. DOI: 10.1016/j.tra.2022.08.005.
- Goswami R., G.Ch. Tripathi. 2019. "Economic, environmental and congestion impact on the life-cycle cost of ownership: a case study in the Delhi transit bus system". *International Journal of Electric and Hybrid Vehicles* 11(1). DOI: 10.1504/IJEHV.2019.098719.
- Grzelec K. 2024. "Wykorzystanie wyników badań marketingowych preferencji i zachowań transportowych na rynku transportu miejskiego - przykład aglomeracji gdańskiej". [In Polish: "Marketing research on transport preferences and behaviors on the urban transport market - the example of the Gdańsk"]. *Marketing i Rynek* 31(5). DOI: 10.33226/1231-7853.2024.5.1.
- 19. Grzelec K., K. Hebel, O. Wyszomirski. 2020. Zarządzanie zbiorowym transportem miejskim w warunkach polityki zrównoważonej mobilności. [In Polish: Managing public transport in the context of sustainable mobility policy]. University of Gdańsk Press.
- 20. Hebel K., O. Wyszomirski. 2016. "Ewolucja postulatów przewozowych dotyczących podróży miejskich mieszkańców Gdyni w świetle wyników badań marketingowych z lat 1985-2015". [In Polish: "Evolution of transport demands concerning urban travel of Gdynia residents in the light of marketing research results from 1985-2015"]. *Problemy Transportu i Logistyki* 35(3). DOI: 10.18276/ptl.2016.35-06.
- 21. Hensher D., P. Stopher, P. Bullock. 2003. "Service quality developing a service quality index for bus contracts". *Transportation Research Part A* 37. DOI: 10.1016/S0965-8564(02)00075-7.
- 22. Hickman R., P. Hall, D. Banister. 2013. "Planning more for sustainable mobility". *Journal of Transport Geography* 3. DOI: 10.1016/j.jtrangeo.2013.07.004.
- 23. Ikeda E., E. Hinckson, K. Witten, M. Smith. 2019. "Assessment of direct and indirect associations between children active school travel and environmental, household and child factors using structural equation modelling". *International Journal of Behavioral Nutrition and Physical Activity* 16(1). DOI: 10.1186/s12966-019-0794-5.

- 24. Kalbar P.P., M. Birkved, M. Hauschild, S. Kabins, S.E. Nygaard. 2018. "Environmental impact of urban consumption patterns: Drivers and focus points". *Resources, Conservation and Recycling* 137: 260-269. DOI: 10.1016/j.resconrec.2018.06.019.
- 25. Kędzior R. 2015. "Informacja pasażerska w publicznym transporcie zbiorowym". [In Polish: "Passenger information in public transport"]. *Transport Miejski i Regionalny* 6.
- 26. Levy J.I., J.J. Buonocore, K. von Stackelberg. 2010. "Evaluation of the public health impacts of traffic". *Environ Health* 9. DOI: 10.1186/1476-069X-9-65.
- 27. Lozzi G., M.S. Monachino. 2021. "Health considerations in active travel policies: A policy analysis at the EU level and of four member countries". *Research in Transportation Economics* 85: 101006. DOI: 10.1016/j.retrec.2020.101006.
- 28. Monchambert G., A. de Palma. 2014. "Public transport reliability and commuter strategy". *Journal of Urban Economics* 81. DOI: 10.1016/j.jue.2014.02.001.
- 29. Mouratidis K., D. Ettema, P. Næss. 2019. "Urban form, travel behavior, and travel satisfaction". *Transportation Research Part A: Policy and Practice* 129: 306-320. DOI: 10.1016/j.tra.2019.09.002.
- Okraszewska R., A. Romanowska, M. Wołek, J. Oskarbski, K. Birr, K. Jamroz. 2018. "Integration of a multilevel transport system model into sustainable Urban mobility planning". *Sustainability* 10(2). DOI: 10.3390/su10020479.
- Olivieri C., X. Fageda. 2021. "Urban mobility with a focus on gender: The case of a middle-income Latin American city". *Journal of Transport Geography* 91. DOI: 10.1016/j.jtrangeo.2021.102996.
- 32. Parasuraman A., V.A. Zeithaml, L.L. Berry. 1985. "A Conceptual Model of Service Quality and its Implication for Future Research". *Journal of Marketing* 49(4): 41-50. DOI: 10.2307/1251430.
- 33. Perveen S., et. al. 2020. "How can transport impacts of urban growth be modelled? An approach to consider spatial and temporal scales". *Sustainable Cities and Society* 55. DOI: 10.1016/j.scs.2020.102031.
- 34. Redman L., et. al. 2013. "Quality attributes of public transport that attract car users: A research review". *Transport Policy* 25. DOI: 10.1016/j.tranpol.2012.11.005.
- 35. Sukhov A., et. al. 2021. "Assessing travel satisfaction in public transport: A configurational approach". *Transportation Research Part D* 93. DOI: 10.1016/j.trd.2021.102732.
- Tanwar R., P.K. Agarwal. 2024. "Analysis of the determinants of service quality in the multimodal public transport system of Bhopal city using structural equation modelling (SEM) and factor analysis". *Expert Systems with Applications* 256. DOI: 10.1016/j.eswa.2024.124931.
- 37. Tavares V.B., S.T. Lucchesi, A.M. Larranaga, H.B.B. Cybis. 2021. "Influence of public transport quality attributes on user satisfaction of different age cohorts". *Case Studies on Transport Policy* 9(3): 1042-1050. DOI: 10.1016/j.cstp.2021.04.018.
- 38. Tyrinopoulos Y., C. Antoniou. 2008. "Public transit user satisfaction: Variability and policy implications". *Transport Policy* 15(4). DOI: 10.1016/j.tranpol.2008.06.002.
- van Lierop D., M.G. Badami, A.M. El-Geneidy. 2018. "What influences satisfaction and loyalty in public transport? A review of the literature". *Transport Reviews* 38(1). DOI: 10.1080/01441647.2017.1298683.

- Wołek M., K. Hebel. 2020. "Strategic Planning of the Development of Trolleybus Transportation Within the Cities of Poland". In: G. Sierpinski (Ed.). Smart and Green Solutions for Transport Systems. 16th Scientific and Technical Conference "Transport Systems. Theory and Practice 2019". Springer Nature Switzerland AG. DOI: 10.1007/978-3-030-35543-2.
- Wołek M., A. Jagiełło. 2017. "Preferencje pasażerów gdyńskiego transportu miejskiego w zakresie wzrostu dostępności przestrzennej usług poprzez wydłużenie trasy linii trolejbusowej". [In Polish: "Preferences of passengers of Gdynia public transport in terms of increasing the spatial availability of services by extending the route of the trolleybus line"]. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach* 332. [In Polish: *Studies of Economics. Scientific Letters of University of Economics in Katowice*]. Available at: https://www.ue.katowice.pl/fileadmin/user_upload/wydawnictwo/SE_Artykuły_321_340 /SE_332/06.pdf.
- 42. Wołek M., A. Szmelter-Jarosz, M. Koniak, A. Golejewska. 2020. "Transformation of trolleybus transport in Poland. Does in-motion charging (technology) matter?" *Sustainability* 12(22). DOI: 10.3390/su12229744.
- 43. World Bank Group. 2018. Financing a Resilient Urban Future. A Policy Brief on World Bank and Global Experience on Financing Climate-Resilient Urban Infrastructure. *Financing a Resilient Urban Future*. DOI: 10.1596/31068.
- 44. Zhang L., H. Chen, S. Li, Y. Liu. 2023. "How road network transformation may be associated with reduced carbon emissions: An exploratory analysis of 19 major Chinese cities". *Sustainable Cities and Society* 95. DOI: 10.1016/j.scs.2023.104575.
- 45. ZKM Gdynia. 2019. Preferencje i zachowania komunikacyjne mieszkańców Gdyni. Raport z badań marketingowych 2018. [In Polish: Preferences and transport behavior of citizens of Gdynia. Marketing research report 2018].
- 46. Zych-Lewandowska M., A. Dobrzycka. 2017. "Wybrane aspekty jakości usług publicznego transportu zbiorowego w Warszawie w opinii jego użytkowników". [In Polish: "Selected aspects of the quality of public transport services in Warsaw in the opinion of its users"]. *Ekonomika i Organizacja Logistyki* 1(4): 101-110. DOI: 10.22630/eiol.2016.1.4.40.

Received 05.10.2024; accepted in revised form 08.02.2025



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