



Paweł Gałka

Faculty of Economics, University of Gdańsk, Poland

<https://orcid.org/0000-0002-4405-9851>

THE SHARE OF PEDESTRIAN TRAFFIC IN THE CITY CENTER AS A DETERMINANT OF THE GOALS OF SUSTAINABLE MOBILITY ON THE EXAMPLE OF ŚWIĘTOJAŃSKA STREET IN GDYNIA

Abstract

The article presents the results of traffic research on Świętojańska Street in Gdynia. The subject of the research was considered significant due to the benefits resulting from changes in the ways of travel (especially in cities) and the increase in the share of sustainable tourism, in particular in the case of pedestrian travel, observed in many European Union cities. The research shows that the share of pedestrian traffic in the center of Gdynia is higher than the average for this city, but at the same time the largest share in travel in this area has passenger cars. Such a division of transport tasks should be considered disadvantageous from the point of view of the goals of sustainable mobility. The article mainly used own research carried out using the observation method within the Civitas Dynamo program, as well as the literature of the subject (articles) and research reports.

Keywords: pedestrian travel, public transport, division of transport tasks

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Introduction

One of the most important challenges in the functioning of cities is congestion and related costs. The reduction of the negative effects of congestion sets the goal of shaping urban mobility in order to increase the share of walking, cycling and public transport in relation to transport of a passenger car. Pedestrian travel is one of the most economically, socially and ecologically effective way of moving

around the city. The processes aimed at making pedestrian traffic more attractive and increasing its share in the displacement structure is called pedestrianization.

The definition of pedestrian traffic is ambiguous. There are no precise definitions of what journeys can be considered as a pedestrian trip. It remains to be decided which travel parameters, i.e. time, distance or destination, should characterize walking as an alternative to other modes of transport and how pedestrian traffic should be examined (Jamroz, 2015).

The increase in the share of pedestrian trips in total trips is beneficial. Pedestrian trips do not cause pollution, noise and minimally contribute to the creation of other external costs.

The increase in the share of pedestrian trips in a given area depends on two groups of factors: motivation and ability to move on foot. Motivational factors relate to the desire to move on foot and are determined by the lifestyle and activity of people. The motivation to carry out a pedestrian trip can be shaped by promoting walking. There are various limitations to the ability to carry out pedestrian travel. The relatively lower speed of pedestrian travel has a negative impact on the tendency to choose them, especially when it comes to long distances. Pedestrian infrastructure and pedestrian integration with other modes of transport, such as the accessibility of public transport, also affect the tendency to travel on foot (Galanis, Eliou, 2012).

Identification and modeling of pedestrian traffic is difficult due to the two-dimensional aspect of movement in relation to the one-dimensional circular motion. Pedestrians, although like road transport use the equivalent of traffic lanes, i.e. pavements, are free to choose the direction in which they move on the pavement. The pace of walking is more chaotic than the movement of vehicles. The road lanes are well defined in the relations for road traffic, the pavements are not. The pace and direction of pedestrian traffic can change at any time (Vanum, Raol, Tiwari, 2017). As a result it is difficult to measure pedestrian traffic (Jamroz, 2015), which is most often studied by direct observation methods (used in research, the results of which are presented in this article) and registration, e.g. from a camera system that allows the calculation of flows, pedestrian tracking by installing appropriate applications on their mobile phones and smartphones. It is also possible to use the panel method and travel diaries as measuring instruments and simulation methods and experiments.

When analyzing pedestrian traffic, it should be noted that the characteristics of flow of people for a given area is different than between areas. It results from (Lue, Miller, 2019):

- various socio-economic characteristics of areas,
- different types of infrastructure,
- different objectives implemented in a given area in relation to and other adjacent areas (usually the role of the center is different, and the role of the suburbs is different),
- pedestrian flow density (which influences time and number of trips),
- personal characteristics of pedestrians.

The high share of pedestrian travels in the division of transport tasks is particularly important in city centers because, first of all, they combine the disadvantages of high

traffic volume. The city center is the place where many destinations are reached, and the limited space enforces a kind of conversion of pedestrian traffic to pedestrian traffic or public transport. This development is mainly influenced by the appropriate spatial development policy, infrastructure investments, appropriate organization of individual and public transport, and promotion of pedestrian traffic (Wołek, 2016).

The goals of sustainable mobility indicate that city center areas should be transformed into traffic zones with a strong traffic restriction (Radzimski, 2012). In this context, the following hypothesis can be formulated: the main measure of the balance of mobility in city centers should be modal split – the division of transport tasks. The aim of the article is to show that the center of Gdynia, despite the actions taken in the field of balancing mobility, does not meet the conditions for recognizing it as an area of sustainable urban mobility.

1. Methodology

Świętojańska Street is a sensitive, in terms of location (close city center), economic, administrative, historical, tourist and recreational area of Gdynia. It is a revitalized street (under the CIVITAS TELLUS project), including a parking zone. Pedestrian traffic takes place on street pavements. The street is single track with one lane in each direction. Trolleybus (daily) and bus (night) lines run along the street. The street is illuminated, equipped with so-called small architecture, parking spaces, bus stops, and the traction network of trolleybuses situated above it.

Measurement of pedestrian traffic within Świętojańska Street was performed on weekdays, Saturdays and Sundays in three consecutive years: 2014, 2015 and 2016. Pedestrian trips were examined using the method of observing the intensity of traffic flows at specific measurement points, along the street cross-section in two different directions, on both its sides, in fifteen-minute time intervals, between 5 a.m. and 10 p.m. The results of measurements were recorded on the observation cards. The bicycle traffic was measured by the same method.

At the same time, in order to calculate the division of transport tasks, at the same measurement points, the number of passengers of public transport was measured using the method of external observation of vehicles.

In order to calculate the number of trips made by passenger cars, the traffic of these vehicles within Świętojańska Street with the use of measuring mechanical instruments – pneumatic sensors (counting the number of vehicle axles exceeding the measuring point and inter-axial distances). In the road traffic research methodology, there are three ways to calculate the number of people moving by cars. The easiest way is to assume that one vehicle is occupied by one person traveling (the driver). Another assumption may also be the acceptance that one car accounts for 1.2 to 1.6 people per vehicle. This size depends on the type of travel. For commuting to work and business, the lower upper limit is assumed for the remaining commuting. (Road infrastructure, 2008). The third way is to use tests that indicate how many passengers travel on average in one vehicle. Such data are collected by the Public Transport Authority in Gdynia in cyclical research "Preferences and communication behaviors of Gdynia's residents". The 2015 survey shows

that in Gdynia the average number of passengers in a passenger car amounted to 1.43 (Preferences and communication behaviors of Gdynia residents in 2015).

2. Results

Results of pedestrian traffic research results in Świętojańska Street indicate its balancing in both studied directions. Pedestrian traffic gradually increases until afternoon (4p.m.–5p.m.), and then decreases. The results of pedestrian traffic measurements for weekdays in 2014–2016 are shown in Figures 1–3.

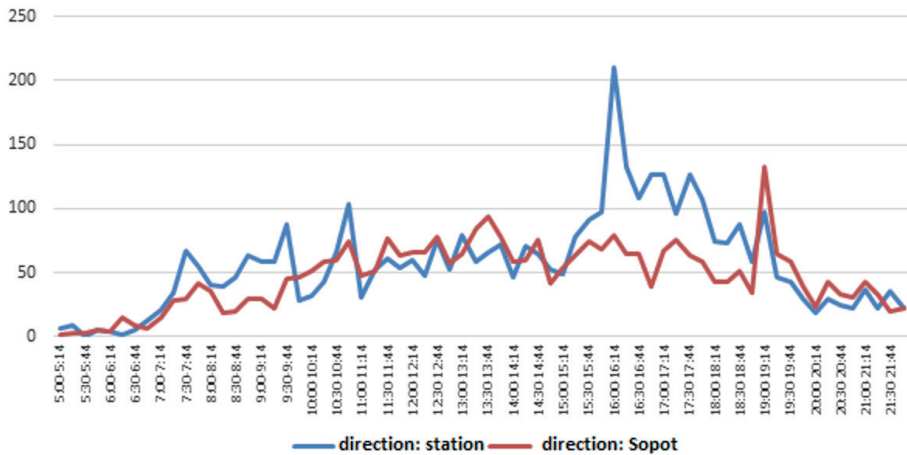


Figure 1. Intensity of pedestrian trips on Świętojańska Street on a weekday (May 2014)
Source: (own research as part of the CIVITAS DYN @ MO project)

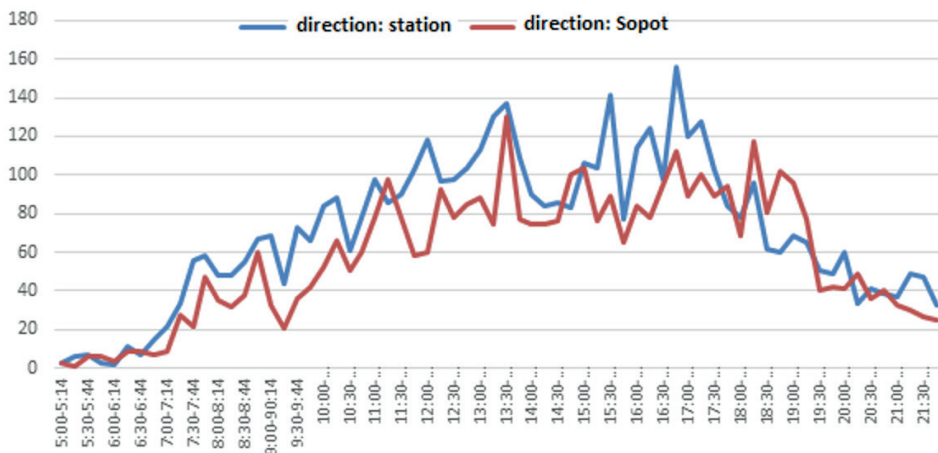


Figure 2. Intensity of pedestrian trips on Świętojańska Street on a weekday (May 2015)
Source: (own research as part of the CIVITAS DYN @ MO project)

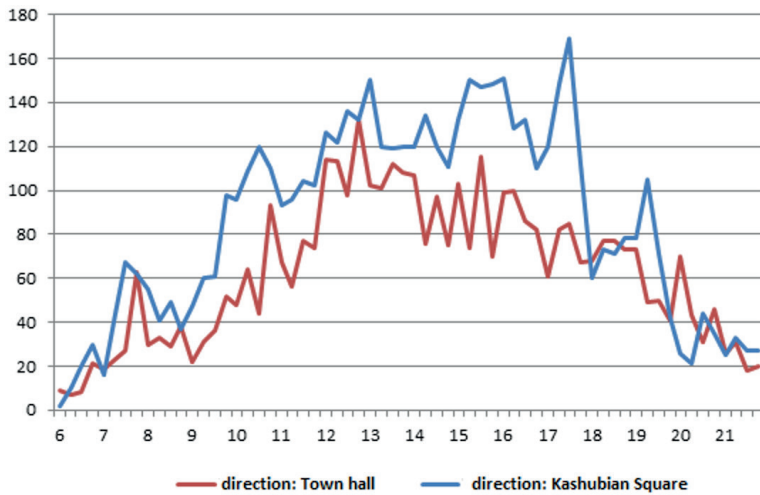


Figure 3. Intensity of pedestrian trips on Świętojańska Street on a weekday (May 2016)
 Source: (own research as part of the CIVITAS DYN @ MO project)

The distribution of pedestrian trips on Świętojańska Street in Gdynia on a daily basis does not undergo significant changes in the following years. On the other hand, the number of pedestrian trips increases. Observed deviations in measurements may be the result of external factors (e.g. weather conditions), whereas significant changes in a given fifteen-minute interval may result from random phenomena (school trips – e.g. measurement towards the Station in Figure 1).

When comparing pedestrian traffic on weekdays and weekends based on the example of the 2015 research, it should be noted that the daily travel distribution is very similar, with the number of walking pedestrians being slightly smaller for weekend days. This is shown in Figure 4.

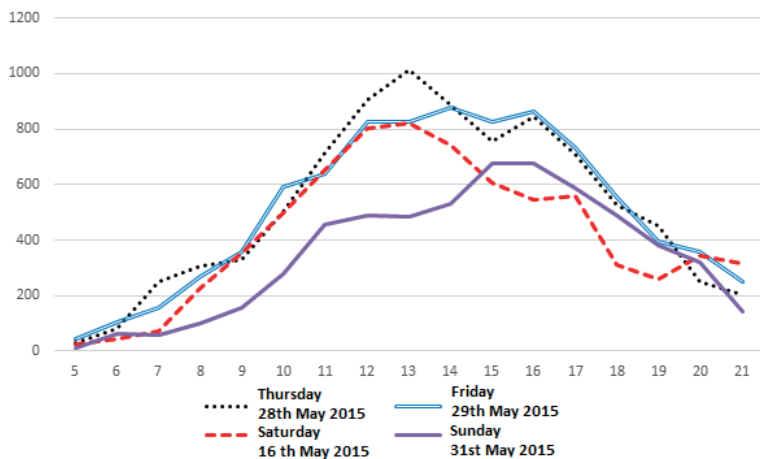


Figure 4. Comparison of changes in pedestrian traffic on weekdays, Saturdays and Sundays
 Source: (own research as part of the CIVITAS DYN @ MO project)

A similar distribution, although different in scale, is shown by the number of people traveling by public transport (trolleybus communication). This is shown in Figures 5 and 6.

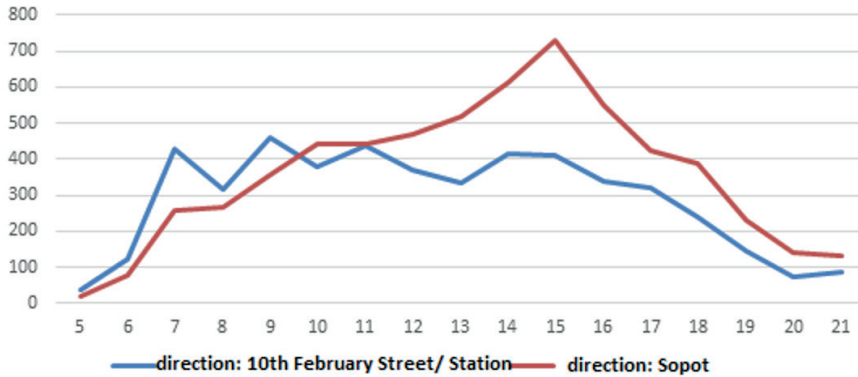


Figure 5. Number of passengers traveling on trolleybuses on Świętojańska Street (Traugutta measuring point) on the week of May 2014

Source: (own research as part of the CIVITAS DYN @ MO project)

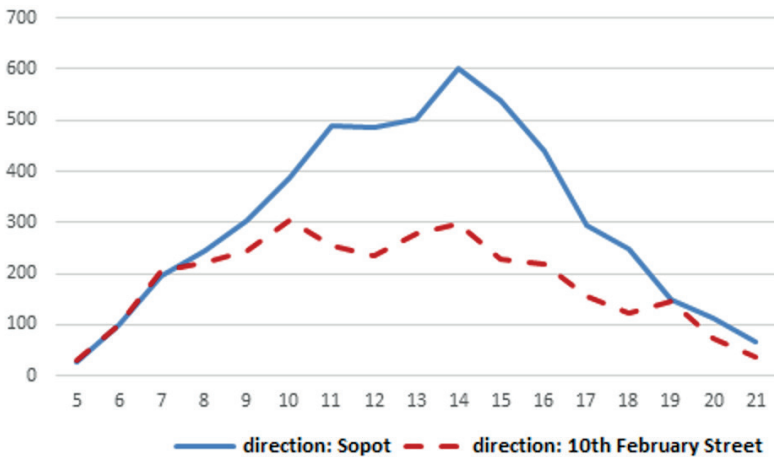


Figure 6. Number of passengers traveling on trolleybuses on Świętojańska Street (Traugutta measuring point) on the week of May 2015

Source: (own research as part of the CIVITAS DYN @ MO project)

The number of public transport passengers increases to the afternoon hours and then decreases to evening hours (up to several passengers per vehicle). More passengers are moving south (towards Sopot). This is characteristic for all studied periods. Attention is drawn to the fact that there is no morning transport peak in public transport within Świętojańska Street in Gdynia.

The first peak for passenger cars is between 7 a.m.–8 a.m and after a short decline it increases again after 9 a.m. The car traffic is clearly smaller after 6 p.m. There is a similar scale in both directions.

Bicycle traffic in the hourly intervals is of individual character (this results in a large dynamics of changes in the relation of one interval to the previous one). Bicycle traffic is the least used way of moving.

Significant changes in the volume of bicycle traffic occur between particular days of the week. This movement, similar in the nature of dynamics, however, differs in magnitude. First of all, increased traffic was registered on Sunday.

The volume of pedestrian traffic in subsequent years is gradually increasing. Cycling is a similar trend. However, the increase in the share of pedestrian and bicycle traffic does not contribute to a reduction in the number of journeys by car. The share of this transport in the implementation of the journey on Świętojańska Street does not change significantly. The decrease in public transport is clearly visible. The share of individual ways of traveling in total trips on weekdays is presented in Table 1.

Table 1. Modal split for Świętojańska Street in 2014–2016

Specification		Weekday		
		5 a.m.–10 p.m.		People per hour
		Number of people	Share	
Passenger car	2014	16,749	47.90%	1,047
	2015	18,042	47.31%	1,128
	2016	17,497	46.12%	1,094
Public transport	2014	10,967	31.36%	645
	2015	11,116	29.15%	695
	2016	10,589	27.91%	662
Pedestrian traffic	2014	7,096	20.29%	417
	2015	8,677	22.75%	542
	2016	9,525	25.11%	595
Bicycles	2014	155	0.44%	9
	2015	298	0.78%	19
	2016	323	0.85%	20
Total	2014	34,967	100.00%	2,118
	2015	38,133	100.00%	2,383
	2016	37,934	100.00%	2,371
Modal split for Gdynia in 2015				
Passenger car	51.50%			
Public transport	36.00%			
Pedestrian traffic	10.90%			
Bicycles	1.60%			

Source: (own research as part of the CIVITAS DYN @ MO project)

Discussion and conclusion

The traffic research on Świętojańska Street demonstrates that this representative area of the center of Gdynia does not meet the conditions for regarding it as an area of sustainable mobility. The analysis of the division of transport tasks shows that from the point of view of the objectives of sustainable mobility policy in the area of Świętojańska Street there is an unfavorable share of passenger cars (higher than the average for Gdynia by 4%), public transport (lower than the average for Gdynia by almost 7%) and bicycles (lower by almost 1%).

The total traffic distribution indicates that the area of Świętojańska Street is characterized by the typical daily distribution of the travel distribution increasing up to afternoon hours. The share of the trips (including the number of passengers traveling) is two times higher than the number of pedestrian trips. This is a disadvantageous phenomenon in the area of the city center. The low share of bicycle trips should also be considered as unfavorable.

From the point of view of the goals of sustainable transport, it is important to reverse the trend of the decrease in public transport on Świętojańska Street, with increasing importance of pedestrian and bicycle traffic, and a decrease in the share of individual car transport.

The high availability of passenger cars for Świętojańska Street area affects the deterioration of pedestrian traffic safety. In conditions of sustainable mobility, pedestrian travel in city centers should have an absolutely dominant share.

An increase in the number of pedestrian trips could be achieved by eliminating or significantly reducing the area of Świętojańska Street for passenger car traffic. Previous activities in this area of the city authorities, consisting of decreasing the traffic by rebuilding the geometry of Świętojańska Street and the introduction of paid parking places should be considered insufficient. On the positive side, however, it is necessary to assess the implementation of pilot reorganization projects and limit the traffic of trucks and delivery cars in the center of Gdynia, through the introduction of a delivery system within the so-called the last mile and undertaking research on the scope of cooperation between the city and employers, the aim of which should be to change the transport behavior of residents to environmental (including the increase in the number of trips by bicycles, electric vehicles, and hybrid vehicles).

Świętojańska Street is predestined for performing the function of a city lounge with dominant commercial and service functions (gastronomy, culture, entertainment). Unfortunately, the projects of transforming this street into the pedestrian area, prepared in the 1990s, have not been implemented against the resistance of residents, including property owners located along the street. Half-measures carried out by the authorities have not brought about good results in terms of sustainable mobility or a change in the functional character of this area of the city.

The exclusion of traffic from Świętojańska Street is favored by the parallel streets (mainly Władysława IV Street) and perpendicular, providing access to Świętojańska Street and a well-developed network of public transport connections, in particular trolleybus, which using battery drive can ensure high accessibility, without the need to build a traction network.

References

- Galanis, A., Eliou, N. (2012), *Procedia – Social and Behavioural Sciences*, 48, pp. 1–2.
- Infrastruktura drogowa. Niebieska Księga* (2008), JASPERS. (Join Assistance to Support Projects in Europa Region), Warszawa, p. 34.
- Jamroz, K. (Ed.) (2015), *Metodologia systematycznych badań zachowań pieszych i relacji pieszy–kierowca wraz z przeprowadzeniem badań pilotażowych Etap I Założenia do metodologii wraz z badaniami pilotażowymi.*, Ministerstwo Infrastruktury i Rozwoju, Warszawa.
- Lue, G., Miller, E. (2019), Estimating a Toronto pedestrian route choice model using GPS data, *Travel Behaviour and Society*, 14, pp. 34–42.
- Preferencje i zachowania komunikacyjne mieszkańców Gdyni w 2018 r.*, <https://zkmgdynia.pl> [Accessed 10 July 2019].
- Radzimski, A. (2012), Ruch pieszy i rowerowy jako elementy systemu zrównoważonego transportu miejskiego w Kopenhadze, *Transport Miejski i Regionalny*, 2, p. 14.
- Vanum, D., Raol, R., Tiwari, G. (2017), *Fundament diagrams of pedestrian flow characteristics: A review.* *Euro Transport Research Review*, Springer, pp. 2–3.
- Wołek, M. (2016), *The significance of pedestrian mobility as shown by the example of the city of Gdynia.* In: Bąk, M. (Ed.), *Transport development challenges in the twenty-first century: proceedings of the 2015 TranSopot Conference*, Springer Proceedings in Business and Economics, pp. 85–92.

Corresponding author

Paweł Gałka can be contacted at: pawel.galka@ug.edu.pl