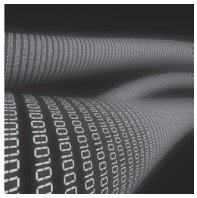

Archives of
Transport System
Telematics

Volume 6

Issue 1

February 2013

Changes of the modal split of traffic in Europe

G. SIERPIŃSKI
SILESIAN UNIVERSITY OF TECHNOLOGY, Faculty of Transport, Department of Traffic Engineering,
Krasińskiego 8, 40-019 Katowice, Poland
EMAIL: grzegorz.sierpinski@polsl.pl

ABSTRACT
Many cities in the world, including cities in Europe, implement a policy aimed at improving the attractiveness of alternatives modes to a private car. The literature often shows impressive changes in the modal split in favour of environmentally friendly means of transportation (public transportation, cycling, going on foot). Because individual cases do not decide of the success of European policies in the field of sustainable transport development, the article summarizes the statistics of modal split of traffic for more than 300 cities in the last 10 years. The data present a problem in Europe and contribute to the debate on changing the current approach to the issue.

KEYWORDS: modal split, sustainable development, alternative transportation

1. Introduction

The problem of efficient transport of persons and loads using the existing and planned transport systems constitutes one of the basic contemporary challenges. This problem increases in particular in city centres where an increasing number of passenger cars often causes a phenomenon of severe congestion. The main question asked by persons, who influence the shaping of city transport systems concerns the method of improving this situation.

An analysis of various initiatives proposed and subsequently implemented by EU member states provides grounds for considering the first decade of the 21st century to be a period of permanent interest in the problem of mobility. The EU policy was reflected, amongst other things, in successive White Papers [25 - 26], setting the road for improving the existing situation through actions forcing changes in the modal split of traffic. The guidelines concern e.g. the share of group transport, changes in the sources of energy used or an increase in the importance of rail transport.

The article focuses on presenting statistics concerning the modal split of traffic on a European scale. Data for the years 2001 to 2011 concerning over 300 European cities were analysed. Describing such phenomena in this way allows for showing the transport problem from a perspective other than the local one. It also constitutes premises for evaluation of the existing approach in this area.

2. Basic trends in changes in the modal split of traffic

The modal split results from choices made by travellers. Subjective choices of single persons provide, as a result, a picture of the split of traffic into means of transport (mobility methods) for a specific area. In such an approach, the modal division can be understood as an assessment of actions performed at an urban, regional or national level, as shaping the transport policy towards pro-ecological mobility methods. There are examples of towns implementing solutions aimed at decreasing the number of passenger cars in their centres. However, still too many cities introduce such solutions only at selected points. The lack of comprehensive approach results in a poor improvement in the situation or even in no improvement.

An analysis of data from 318 European cities has allowed to define basic trends in changes with reference to the share of individual mobility methods[1]. A general comparison of data for consecutive years has allowed for obtaining lines of the trend defined for various mobility methods (Figure 1). Efforts to change habits of persons travelling in passenger cars bring results in the form of a decrease in the use of this means of transport. However, the decrease in this value is too small, considering the period of

[1] Because of the data availability, four mobility methods have been distinguished (passenger car, public transport, bicycle, walking).

10 years. At the same time, the data show a growing trend towards travelling by bicycle. A decrease in the share in public transport can be seen over a period of 10 years, however, a growing trend has been observed in the last three years.

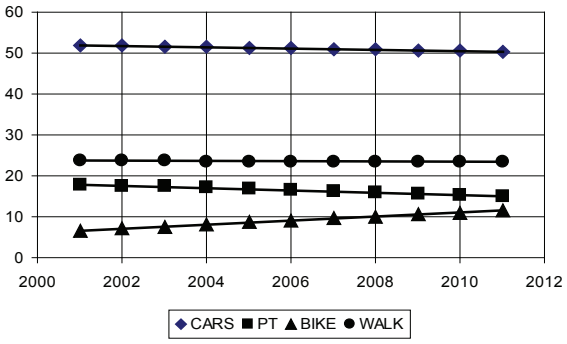

Fig. 1. A comparison of the trend lines for the share of various mobility methods in traffic [own work]

Table 1 contains a comparison of values for the beginning and end years of the analysis period. By taking this perspective, a higher share of public transport in traffic can be assumed in 2011 as compared to 2001.

Table 1. Comparison of average share of various mobility methods for the beginning and end years of the analysis (2001 and 2011) [own work]

Mode of transport	Average values of modal split in 2001	Average values of modal split in 2011	Comparison [%]
Cars	49.3	44.6	-9.56
Public Transport	19.7	20.3	2.87
Bike	7.1	9.2	30.04
Walk	23.9	25.9	8.05

3. Relative frequency and modal split of traffic in Europe

Changes made for individual cities should constitute coherent plans distinguishing both restrictive actions for passenger cars and supporting alternative mobility methods. Only an integrated approach to the problem allows changing the transport behaviour of travellers. Experience of numerous cities shows that the use of various solutions in the field of transport telematics can support the achievement of the aforementioned goals effectively (including [8 – 9, 12]). Such actions should also include organizational changes and the use of education for shaping the transport behaviour of future generations. The developed strategies, in accordance with basic principles of sustainable development [10], should be preceded by extensive studies of needs pertaining to mobility [22 - 23]. Otherwise, if there is no comprehensive approach, the results will not be consistent with the preliminary assumptions of created developmental strategies. Some of analysed European cities revealed "considerable remoteness" from the most frequent values. With a view to presenting the degree of values clustering and shares of individual mobility methods in traffic and defining the possible dispersion of data, division rows were prepared in which 10 identical class ranges were distinguished. The data obtained are presented in Table 2 in the form of relative frequencies, as divided into consecutive years of the analysis. The most constant range of occurrence in traffic applies to pedestrian travel. The majority of data for nearly all years of the analysis fell within the range of 20-30%. The situation is similar for bicycle travel – in this case the percentage share below 10% prevails. On the other hand, the highest dispersion and variability prevailing in consecutive years are characteristic of the share of passenger cars in traffic. To visualize the degree of data dispersion more effectively, the values of standard deviation and the coefficient of variation presenting deviation per the mean unit [17] defined by the following formula (1):

$$W = S/\bar{x} = \frac{\sqrt{\frac{1}{n-1}\cdot\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2}}{\frac{1}{n}\cdot\sum_{i=1}^{n}x_i} \quad (1)$$

Table 2. Comparison of relative frequencies of the share of individual mobility methods in traffic in the years 2001-2011 [own work]

Intervals	Years										
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Cars											
0 – 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 – 20	3.0	0.0	0.0	0.0	0.0	3.2	4.5	0.9	0.0	2.4	6.7
20 – 30	4.5	0.0	5.6	0.0	8.0	6.5	9.1	0.9	11.6	11.9	13.3
30 – 40	14.9	7.7	5.6	12.5	0.0	19.4	18.2	12.6	18.6	9.5	26.7
40 – 50	28.4	38.5	16.7	25.0	16.0	19.4	9.1	30.6	9.3	21.4	13.3
50 – 60	28.4	46.2	33.3	25.0	28.0	16.1	45.5	33.3	25.6	38.1	20.0
60 – 70	19.4	0.0	33.3	25.0	28.0	29.0	13.6	19.8	23.3	9.5	13.3
70 – 80	1.5	7.7	5.6	12.5	20.0	6.5	0.0	0.9	11.6	4.8	6.7
80 – 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	2.4	0.0
90 – 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public Transport (PT)											
0 – 10	11.9	0.0	44.4	50.0	48.0	45.2	36.4	37.8	51.2	23.8	33.3
10 – 20	59.7	92.3	33.3	31.3	32.0	16.1	36.4	45.0	27.9	47.6	13.3
20 – 30	13.4	0.0	16.7	6.3	16.0	19.4	0.0	13.5	9.3	14.3	33.3
30 – 40	10.4	7.7	0.0	12.5	0.0	19.4	13.6	3.6	7.0	9.5	13.3
40 – 50	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	4.7	4.8	6.7
50 – 60	1.5	0.0	0.0	0.0	4.0	0.0	9.1	0.0	0.0	0.0	0.0
60 – 70	3.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0
Bike											
0 – 10	79.1	69.2	77.8	68.8	88.0	87.1	68.2	36.0	83.7	57.1	53.3
10 – 20	14.9	30.8	16.7	25.0	12.0	12.9	9.1	37.8	4.7	31.0	40.0
20 – 30	4.5	0.0	5.6	6.3	0.0	0.0	18.2	23.4	11.6	9.5	6.7
30 – 40	1.5	0.0	0.0	0.0	0.0	0.0	4.5	1.8	0.0	2.4	0.0
40 – 50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Walk											
0 – 10	3.0	0.0	0.0	0.0	4.0	3.2	9.1	8.1	2.3	14.3	6.7
10 – 20	28.4	23.1	16.7	37.5	32.0	35.5	22.7	41.4	20.9	26.2	26.7
20 – 30	55.2	69.2	83.3	62.5	60.0	29.0	45.5	45.0	48.8	45.2	40.0
30 – 40	10.4	7.7	0.0	0.0	4.0	12.9	18.2	4.5	23.3	7.1	13.3
40 – 50	3.0	0.0	0.0	0.0	0.0	16.1	0.0	0.9	2.3	4.8	6.7
50 – 60	0.0	0.0	0.0	0.0	0.0	3.2	4.5	0.0	0.0	0.0	6.7
60 – 70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
70 – 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0

© Copyright by PSTT , All rights reserved. 2013

Table 2. Comparison of relative frequencies of the share of individual mobility methods in traffic in the years 2001-2011 [own work]

Measure	Years										
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Cars											
S	12.69	9.23	12.55	12.43	13.13	15.51	14.70	10.25	15.34	14.94	15.55
W	0.26	0.18	0.23	0.22	0.23	0.30	0.32	0.20	0.30	0.30	0.35
Public Transport (PT)											
S	11.75	4.74	9.84	10.45	10.88	11.49	17.99	6.91	11.33	10.75	12.94
W	0.60	0.27	0.68	0.75	0.82	0.65	0.85	0.51	0.79	0.60	0.64
Bike											
S	6.97	5.25	6.45	8.12	4.00	4.92	10.74	8.64	7.38	8.15	8.29
W	0.98	0.72	1.08	1.03	0.59	1.29	1.26	0.61	1.09	0.87	0.89
Walk											
S	7.79	6.21	3.63	5.28	5.40	12.91	10.23	8.20	9.41	12.17	12.30
W	0.33	0.25	0.15	0.25	0.25	0.47	0.43	0.39	0.35	0.52	0.48

S – standard deviation; W – coefficient of variation

4. Alternative modes of transportation and passenger cars

in the preceding chapters, independent shares of individual mobility methods were considered. As the basic aim of the actions taken involves changing the ratio between the number of trips in a passenger car and other means of transport, it is advisable to determine changes in these ratios in the analysed period (2001-2011). Figures 2 and 3 present graphic changes in the proportion values: public transport: passenger car; bicycle: passenger car; pedestrian trip: passenger car and the total share of all three alternative methods of travelling as compared to the passenger car share in traffic. In the case of maximum values, a high data dispersion is conspicuous. Table 3 contains a comparison of values for the beginning and end years of the analysis period. From 2009, changes in the direction of alternative mobility methods can be seen. However, it is too early to conclude that this situation constitutes a permanent positive trend and will prevail in the nearest future.

Table 3. Comparison of average shares of alternative mobility methods to the share of passenger cars in traffic for beginning and end years of the analysis (2001 and 2011) [own work]

Mode of transport	Average values (2001)	Average values (2011)	Comparison (2001/2011) – 100%
Public Transport	0.51	0.56	9.85
Bike	0.16	0.24	50.16
Walk	0.55	0.74	35.44
PT + Bike + Walk	1.22	1.55	26.73

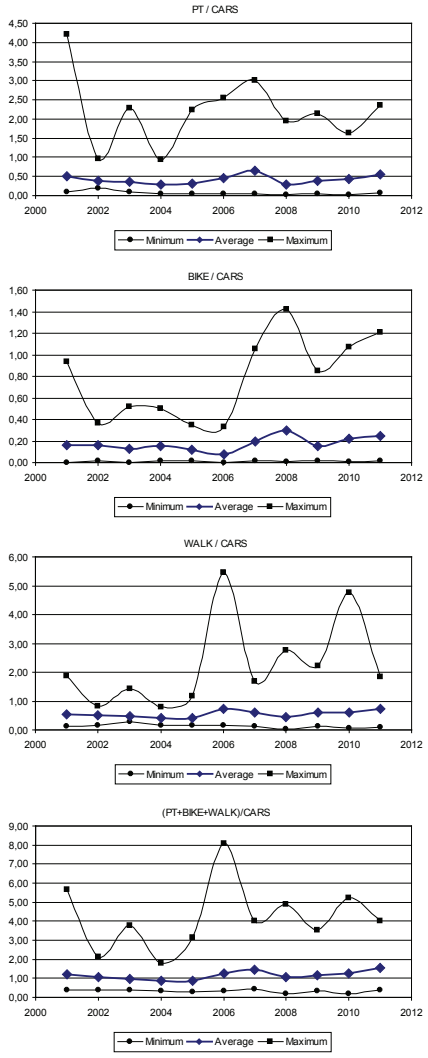

Fig. 2. Shares of alternative mobility methods as compared to the share of passenger cars in traffic in European cities in the years 2001-2011 (extreme values and means)

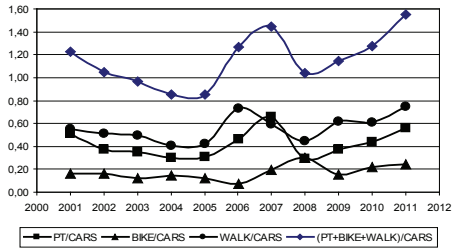

Fig. 3. Cumulative breakdown of the variability of the values of alternative ways of travelling as compared to the share of passenger cars in traffic in European cities in the years 2001-2011

4. Conclusion

Although messages of the European Commission present general suggestions concerning the development of transport in the European

Union, member states (on a national level) and even European cities are obliged to define an appropriate strategy for development. This strategy should lead to mode balancing in a longer perspective. As regards the issues covered in this article, the balancing refers to the necessity of changing the travelling behaviour and decreasing the share of passenger cars in city traffic to replace it with other ecological travelling methods (public transport, cycling, pedestrian travel).

An analysis of data concerning the modal split from over 300 European cities allows showing a general situation. The problem of too slow a decrease in the share of trips in a passenger car in traffic can be observed here. A general declining trend for the share of public transport trips is also an alarming phenomenon, however, an increase in this value has been observed in the last 3 years. Certainly, an increase in the share of bicycle traffic should be emphasized.

The collected data pertaining to modal splits in numerous European cities should be supplemented with accurate information concerning the scope of the developmental strategy adopted in these cities as well as the travelling behaviour of travellers and the influence of external factors. Only these data put together will allow for establishing justified modal split models in a general form [14]. Appropriate models will make it possible to support cities in defining more effective directions for development and will facilitate making decisions concerning individual initiatives.

Bibliography

[1] Autolib' Official Site, www.autolib.eu/

[2] BRZEZIŃSKI A., MASŁOWSKI K., PIASECKA A.: Samochody wykorzystywane inaczej. Konferencja Naukowo Techniczna „Miasto i Transport 2012. Innowacyjność Transportu – Oszczędzanie Energii", Politechnika Warszawska, 18 kwietnia (2012)

[3] European Platform on Mobility Management. www.epomm.eu

[4] MACIOSZEK E.: Geometrical Determinants of Car Equivalents for Heavy Vehicles Crossing Circular Intersections. In J. Mikulski (Ed.): TST 2012, CCIS vol. 329, pp. 221–228, Springer, Heidelberg (2012)

[5] MACIOSZEK E.: The Influence of Motorcycling and Cycling on Small One-Lane Roundabouts Capacity. In J. Mikulski (Ed.): TST 2011, CCIS vol. 239, pp. 291–298, Springer, Heidelberg (2011)

[6] MANTERYS T.: Badanie sprawności funkcjonowania wydzielonych drogowych pasów autobusowych w Krakowie w ciągu alei Trzech Wieszczów. Transport Miejski i Regionalny 7,8, pp.26-30 (2010)

[7] MATHEW T. V., KRISHNA RAO K. V.: Introduction to Transportation Engineering. Civil Engineering – Transportation Engineering. IIT Bombay, NPTEL ONLINE, http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/

[8] MIKULSKI J.: Telematic Technologies in Transportation. In Janecki R., Sierpiński G. (Ed.): Contemporary transportation systems. Selected theoretical and practical problems. New Culture of mobility, pp.131-143, Publishing House of the Silesian University of Technology. Monograph no. 324. Gliwice (2011)

[9] NOWACKI G. (ed.): Telematyka transportu drogowego. ITS Warszawa (2008)

[10] Our Common Future. Report of the World Commission on Environment and Development, Transmitted to the General Assembly as an Annex to document A/42/427 – Development and International Co-operation: Environment http://www.un-documents.net/wced-ocf.htm (1987)

[11] PUŁAWSKA S., STAROWICZ W.: Wykorzystanie wydzielonych drogowych pasów autobusowych w Krakowie przez pojazdy miejskiego transportu zbiorowego. Transport Miejski i Regionalny 7,8 (2010)

[12] SIERPIŃSKI G., CELIŃSKI I.: Use of GSM Technology as the Support to Manage the Modal Distribution in the Cities. In: Subic A., Wellnitz J., Leary M., Koopmans L. (Eds.): Sustainable Automotive Technologies 2012, pp. 235-244, Springer, Heidelberg (2012)

[13] SIERPIŃSKI G.: Integration of activities as a method to the sustainable mobility. In: Janecki R., Sierpiński G. (Ed.): Contemporary transportation systems. Selected theoretical and practical problems. New Culture of mobility, pp. 93-102. Publishing House of the Silesian University of Technology. Monograph no. 324. Gliwice (2011)

[14] SIERPIŃSKI G.: Theoretical Model and Activities to Change the Modal Split of Traffic. In J. Mikulski (Ed.): TST 2012, CCIS vol. 329, pp. 45–51, Springer, Heidelberg (2012)

[15] SIERPIŃSKI G.: Travel behavior and alternative modes of transportation. In J. Mikulski (Ed.): TST 2011, CCIS vol. 239, pp. 86–93, Springer, Heidelberg (2011)

[16] SIERPIŃSKI G.: Zachowania komunikacyjne osób podróżujących a wybór środka transportu w mieście. Prace Naukowe Politechniki Warszawskiej series Transport z. 84, Analiza i badania systemów transportowych i ich elementów, pp. 93-106, Politechnika Warszawska, Warszawa (2012)

[17] SNARSKA A.: Statystyka. Ekonometria. Prognozowanie. Placet. Warszawa (2007)

[18] STAROWICZ W.: Zarządzanie mobilnością wyzwaniem polskich miast. Transport Miejski i Regionalny vol. 1, pp. 42-47 (2011)

[19] SUCHORZEWSKI W.: Opłaty za wjazd do obszarów śródmiejskich – sukcesy i porażki. In: Kaczmarek M., Krych A.: (Eds.): Skuteczne zmniejszenie zatłoczenia miast, Poznań – Rosnówko, pp. 195-206 (2009)

[20] Transit Estimation and Mode Split. NHI course on Travel Demand Forecasting (152054A) www.ctre.iastate.edu/educweb/ce451

[21] Transport in Figures. Statistical Pocketbook 2012. Luxembourg: Publications Office of the European Union (2013)

[22] Travel Survey Manual, Travel Model Improvement Program, Prepared by Cambridge Systematic, Inc., for U. S. Department of Transportation and U.S. Environmental Protection Agency, July (1996)

[23] Travel Survey Methods Committee (ABJ40): The On-Line Travel Survey Manual, http://www.travelsurveymanual.org/

[24] Velib' Official Site, www.velib.paris.fr/

[25] White Paper: European transport policy for 2010: time to decide. COM(2001) 370.

[26] White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. COM(2011) 144.

© Copyright by PSTT , All rights reserved. 2013