MOBILITY IN TRANSPORTATION SURVEYS

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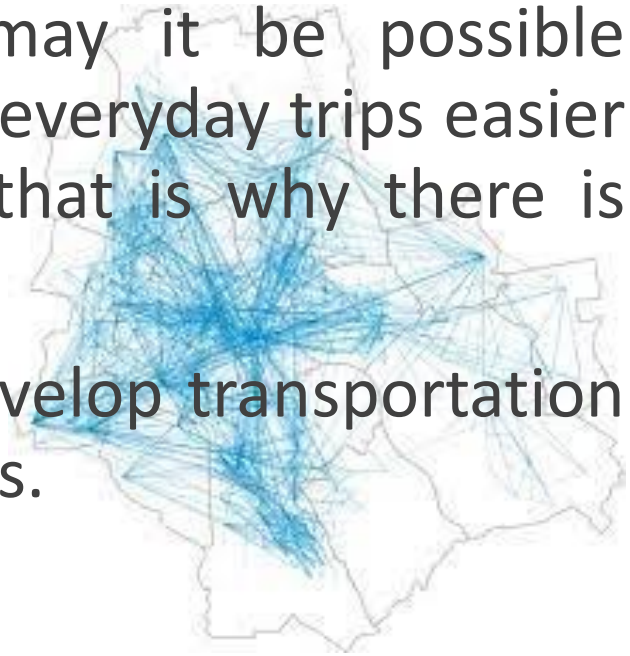
Transport models

- Transport demand model is a mathematical representation of inhabitants behaviour in trips.
- Complex transportation analyses, which may it be possible to improve transportation systems and make everyday trips easier and safer, require the usage of TDM, and that is why there is a need to develop it.
- Moreover, there is a need to use TDM to develop transportation plans, which are required by Polish regulations.



Transport models

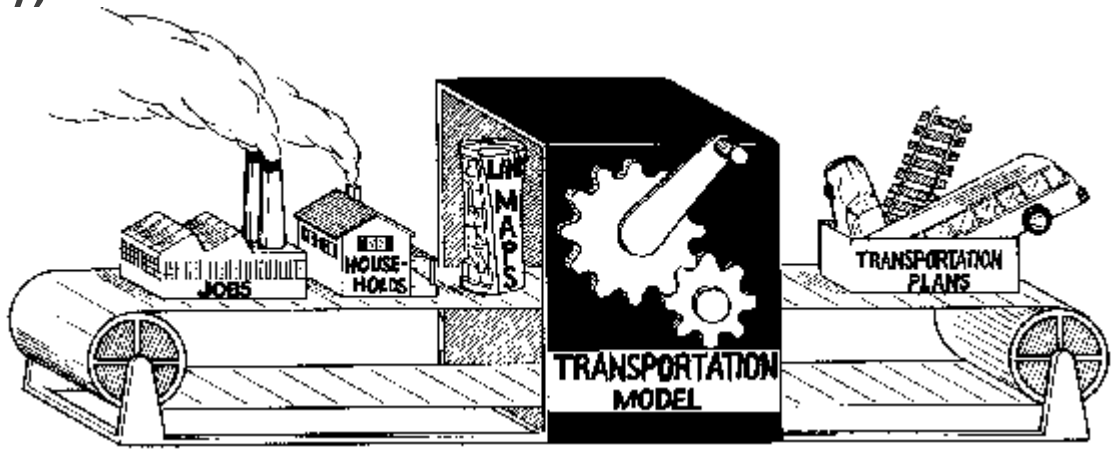
TDM is one of the key tools to support modern transport management, it enables:

- the full scope of transport system performance,
- analysis and estimation of transport system service,
- road network optimization and determination of the most favourable location new investments,
- cost and benefits analyses to determine the effectiveness of transportation investment,
- determination of changes in traffic conditions,
- optimization of traffic management in transport systems.

Transport models

Four-step transport demand models are the most common idea of TDM. It consists of four steps:

- trip generation (How much?),
- trip distribution (Where from, Where to?),
- mode choice or modal split (What?),
- traffic assignment (Which way?).



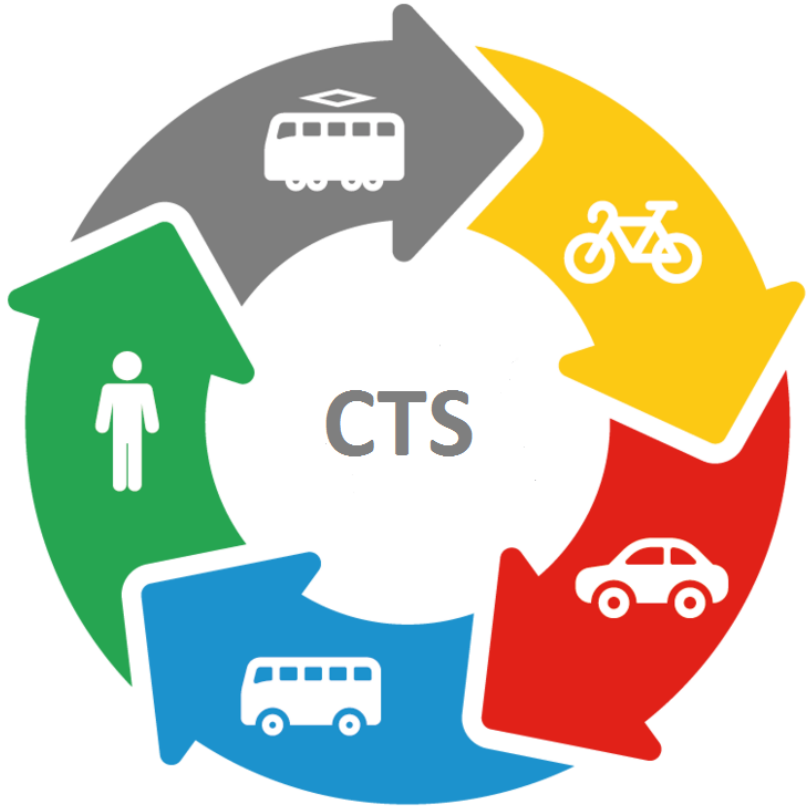
Mobility rate in TDM

- the questionnaire surveys are the base technique for data on the transport behavior of the inhabitants,
- the average number of trips per the selected time period is determined based on the survey data,
- based on this data, the percentage of people in the sample in relation to the total number of people in the population,
- to verify the number of trips computed by the first step of TDM, its comparison to the number of inhabitants in the population multiplied by the mobility ratio may be done.

Comprehensive transport studies as a source of data for TDM

Determination of data on transportation behavior of inhabitants of:

- the study area,
- traffic,
- passenger counts,
- freight traffic data (vans and trucks).



Comprehensive transport studies as a source of data for TDM

The following research can be done as a part of comprehensive transport studies:

- survey households in the study area,
- survey drivers on the cordon of the study area,
- survey of passengers of public transit on the cordon of the study area,
- traffic volume counts and its composition at screen lines,
- traffic volume counts and its composition at cordon lines,
- freight traffic in the study area,

Comprehensive transport studies as a source of data for TDM

The following research can be done as a part of comprehensive transport studies:

- traffic volume counts and its composition in the most important junctions of the road network,
- trip production and attraction by selected places,
- the number of travelers (demand) in public transit,
- the number of travelers using railway stations, bus stations, etc.,
- the impedance function parameters of the road and street network elements of the study area.

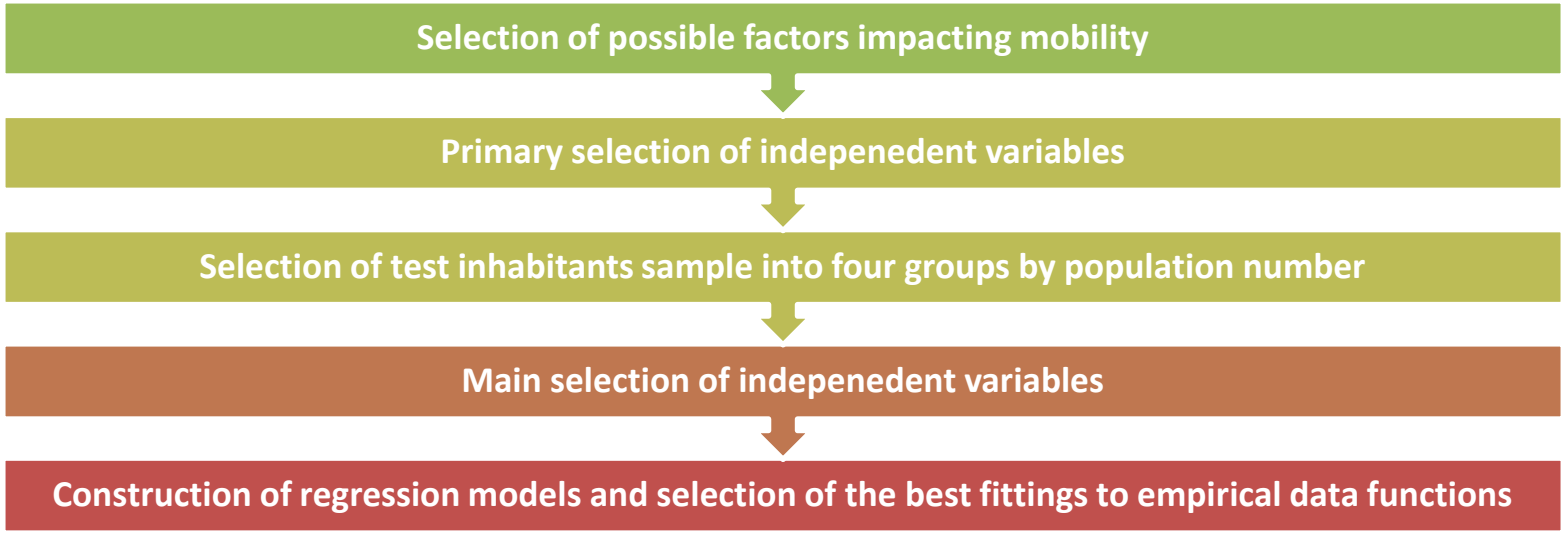
Review of mobility studies in Poland

The largest number of studies that recorded mobility data was carried out in the last decade. Table presents the values of mobility rates broken down by city size, determined based on selected studies of transport behavior in Poland.

No.	City size	*City*	Mobility rate	*Survey year*
1	to 100,000 inhabitants	Piekary Śląskie	1.84	2018
2		Mysłowice	1.43	2018
3		Krosno	1.90	2008
4		Siemianowice Śląskie	1.67	2018
5		Jaworzno	2.18	2018
6	from 100,000 to 200,000 inhabitants	Ruda Śląska	1.94	2018
7		Bytom	1.95	2018
8		Chorzów	2.31	2018
9		Gliwice	2.06	2018
10		Bielsko-Biała	2.20	2015
11		Rybnik	1.60	2018
12		Rybnik	1.62	2015
13		Dąbrowa Górnicza	2.36	2018
14		Opole	1.28	2016
15		Kielce	2.12	2015
16		Olsztyn	2.20	2009
17		Rzeszów	2.04	2015
18		Rzeszów	1.80	2011
19		Rzeszów	1.86	2009
20	from 200,000 to 500,000 inhabitants	Gdynia	1.65	2015
21		Gdynia	1.61	2010
22		Sosnowiec	1.89	2018
23		Szczecin	1.9	2016
24		Szczecin	1.25	2010
25		Toruń	2.23	2016
26		Bydgoszcz	2.25	2013
27		Katowice	2.14	2018
28		Gdańsk	2.1	2016
29		Gdańsk	1.93	2009
30	from 500,000 to 1,000,000 inhabitants	Poznań	1.7	2013
31		Wrocław	1.7	2018
32		Wrocław	1.87	2010
33		Łódź	2.40	2013
34		Kraków	2.02	2013
35	over 1,000,000 inhabitants	Warszawa	1.99	2015

Mobility models including one independent variable

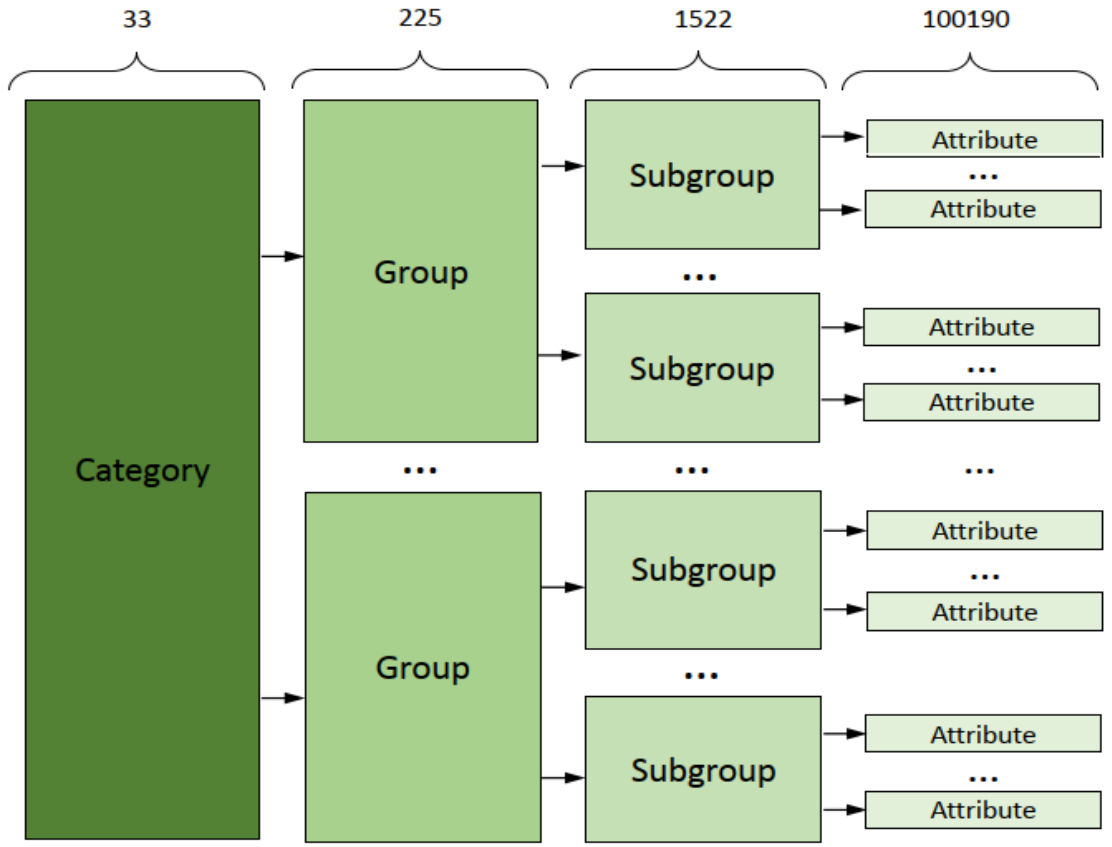
The process of developing mathematical models describing the number of residents' trips on an average working day was carried out in accordance with the diagram.



Mobility models including one independent variable

The database of the Central Statistical Office consists of:

- 33 categories,
- 225 groups,
- 1,522 subgroups
- 100,190 features.

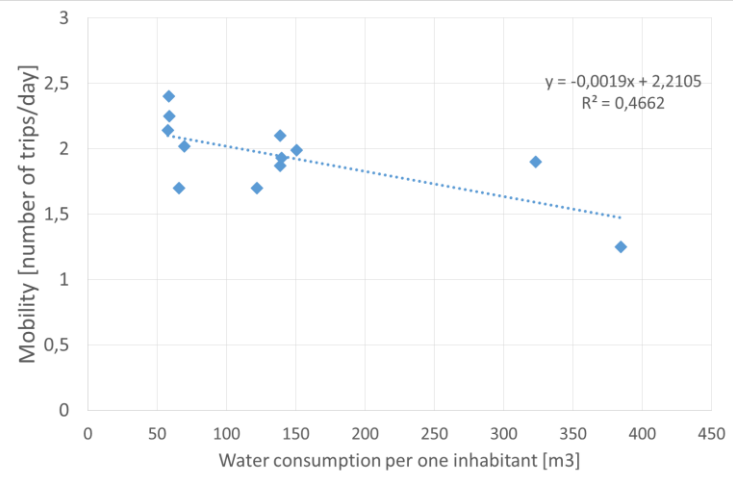


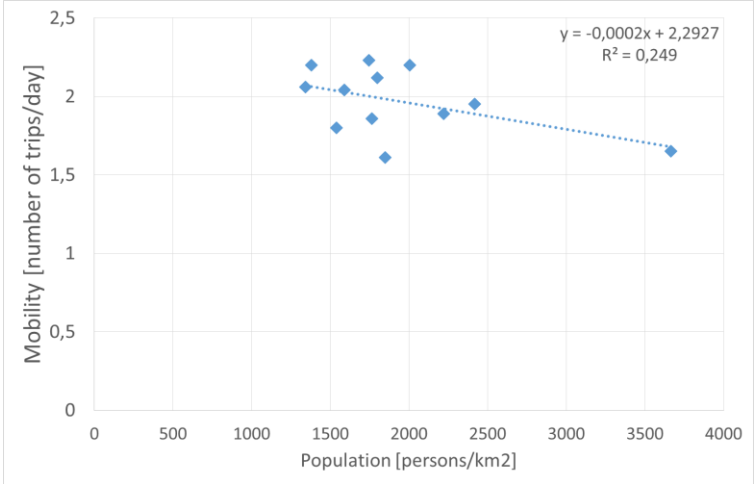
Mobility models including one independent variable

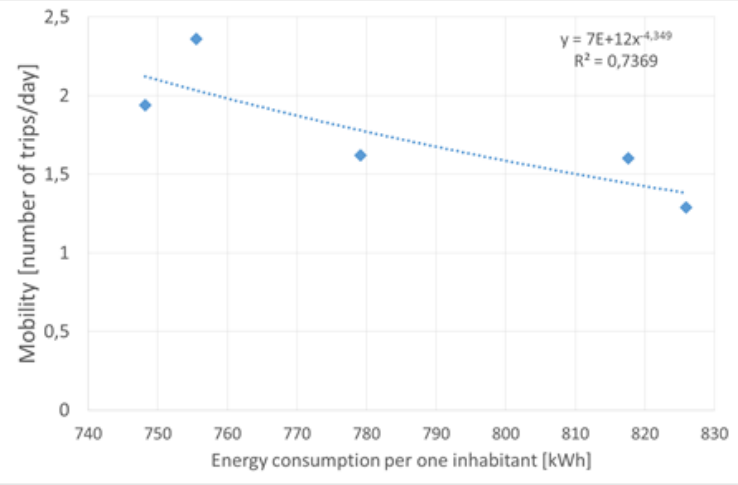
The criterion for the cities' division into individual groups, the so-called quantiles.

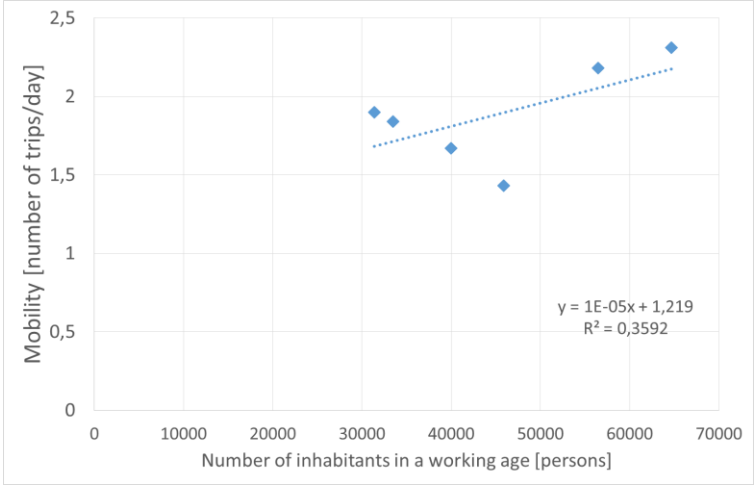
No.	Quantile	*Inhabitants range*	Number of cities in given range	*Sample of the dependent variable*
1	*inhabitants number*> $k_{75\%}$	over 251,297	9	12
2	$k_{50\%}$<*inhabitants number*≤ $k_{75\%}$	from 138,000 to 251,297	9	12
3	$k_{25\%}$<*inhabitants number*≤ $k_{50\%}$	from 107,590 to 138,000	4	5
4	*inhabitants number*≤ $k_{25\%}$	below 107,590	6	6

The results of the selected models









Conclusions

- an attempt was made to develop a model of the relationship between the mobility index and other factors describing: demographic, social and economic determinants of traffic formation,
- 19 were selected from among 100,190 traits,
- it has been noticed that the transport behavior of residents varies depending on the size of the city,
- the results of these studies are mathematical models describing the relationship between the mobility index and the aforementioned independent variables,

Conclusions

- the determination coefficients of models with one independent variable was at a low or medium level,
- the highest values of the coefficient of determination were determined for cities for the 50% quantile - the relationship between the mobility index and electricity consumption per capita,
- the lowest for the quantile group 75% - the relationship between the mobility index and the population.

THANK YOU FOR YOUR ATTENTION!

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