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THE USAGE OF TRANSPORT SURVEY IN ZILINA TRANSPORT MODEL

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Knowledge on the mobility habit is one of the most important goals, which can lead to the better transport planning. For this reason the transport household survey in the city of Zilina was being carried out last year. The data from this survey were combined with other data in order to set-up the reliable input data for Zilina transport model. This model can be used for the transport planning and modelling in order to forecast the future status of traffic impact on the transport infrastructure. The most interested issues are presented and discussed in this paper.

Keywords: transport modelling, transport model, transport survey

1. Introduction

In the recent years the land-use change was evident. The main problem of cities such as Zilina or other cities is the fact that the politics has worked mainly on the improving the economical level, standard of living, looking for investors, etc. Moreover the economists presented the forecasting of economic impact, but they forgot to prepare the transport infrastructure of our cities or change the concepts of transport management. Now we are surprised and we are living in the same transport problems as they are in the Western-European countries such as congestion, problems of parking, etc. For policy makers the linkage between transport and investments [1] is often missing. The main issue for city of Zilina, with population about 86 thousands, consists in the fact that there are presented the serious problems with transport, traffic and land-use. The city represents the important junction, which connects transport infrastructure in the North-South and East-Western direction. In the past there was no evidence for using or developing city transport model in Zilina. Therefore the task for modelling was to find out the objective reasons and provide the adequate solution for municipality, which has been criticized from unsatisfied citizens who perceive the quality of urban life. Therefore the task for transport model can be in providing the information about social support for transport policy measures as already presented in [2].

2. The Transport Survey

In June 2012 the municipality with cooperation of the University of Zilina ran the household survey [3]. We have used the same method, which Germany is using since 1972 [10]. We have selected the 2000 random households, which sample size was at min. 1400 households: 250 of total were the companies' addresses that were excluded from survey. The final sample size was 1067 households, number of persons in survey: 2951, total trips: 5887.

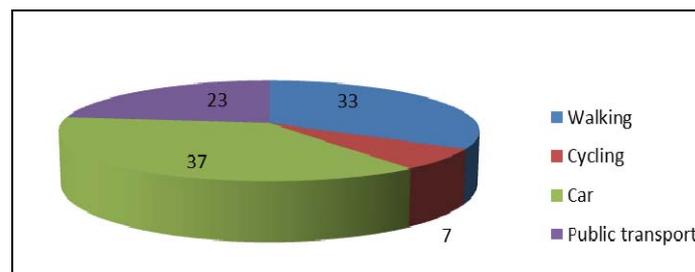


Figure 1. The modal split in city of Zilina (2012)

The survey pointed on the high share of walking (33%) in the city. The alarming is high share of car usage (37%) that is related to the increasing trend of car usage. On the contrary the Public Transport has just 23 % share. Interesting issue is related to the cycling where the share represents about 7%. Especially the trips in city parts distanced on the suburb of city proved the high share of trips, see Figure 2.

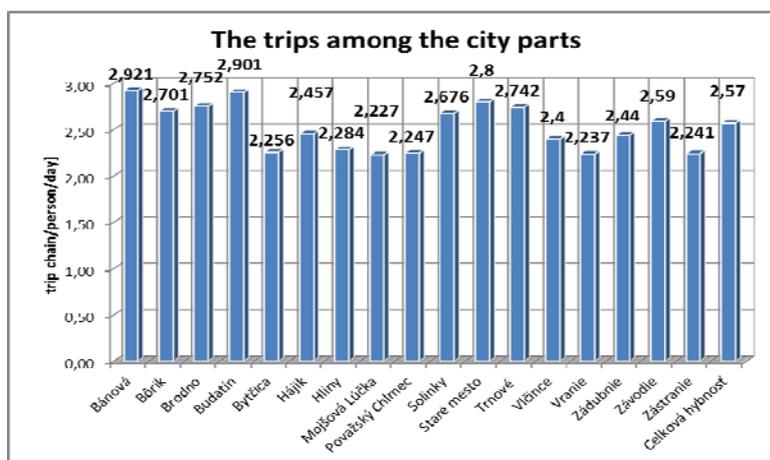


Figure 2. The comparison of trips among city parts

Also the distribution of the trips confirms the theory of two peaks during the daytime. One in the morning and the second during the afternoon, see Figure 3.

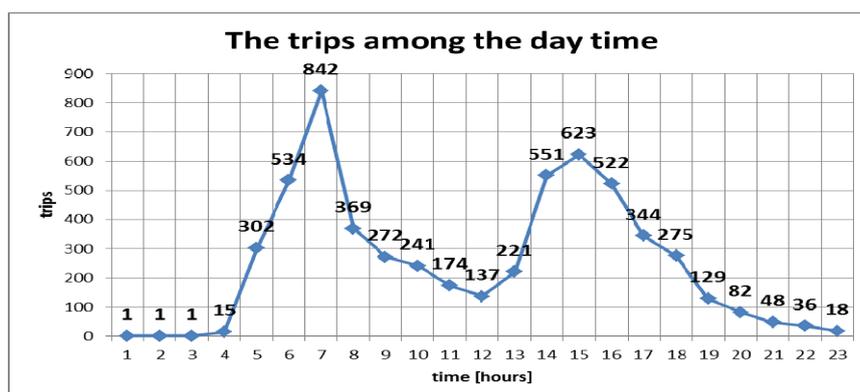


Figure 3. The trips among the day-time

Citizens trips are related most of trip purposes to the relations Home-Work or Work-Home, see Table 1.

Table 1. Comparison of trips purposes in relation origin – destination in %

Type	Trip chain (Origin - Destination)	Share %
1.	Home - Work	18,85%
2.	Work - Home	16,74%
3.	Shopping, Services - Home	13,28%
4.	Home - Shopping, Services	9,90%
5.	School - Home	6,36%
6.	Home - School	6,33%
7.	Home - Relax	4,81%
8.	Relax - Home	4,62%
9.	Work - Shopping, Services	3,02%
10.	Others - Work	1,81%
11.	Private - Home	1,67%

Type	Trip chain (Origin - Destination)	Share %
12.	Home - Others	1,64%
13.	Home - private	1,50%
14.	Others - Home	1,48%
15.	Shopping, Services - Shopping, Services	1,39%
16.	Others - School	0,63%
17.	Work - Work	0,56%
18.	Work - Others	0,52%
19.	Others - Shopping, Services	0,52%
20.	School - Work	0,51%
21.	Culture - Home	0,44%
22.	Home - Culture	0,42%

The following Table 2 shows the share of destination purposed among different means of transport. Most of trips related to the work are served by car, then public transport, walking and, lastly, by cycling. Interesting are results related to the shopping or services where the citizens marked as the most used means of movement – walking.

Table2. Destination purpose of travel and mean of transport (%)

	Walking	Cycling	Car	PT
Work	3,09%	1,39%	11,87%	5,65%
School	3,44%	0,05%	1,72%	2,59%
Schopping, services	6,31%	0,80%	4,67%	3,56%
Culture	0,23%	0,00%	0,19%	0,09%
Private	0,83%	0,38%	0,49%	0,30%
Relax	3,11%	1,01%	1,11%	0,43%
Home	14,23%	3,30%	16,04%	11,16%
Other	0,40%	0,18%	1,11%	0,28%

In the following Figure 4 the comparison of trips realized by different means of transport is shown. The highest share has walking; interested is, for example, cycling, which has different peaks in comparison with other means of transportation or movement.

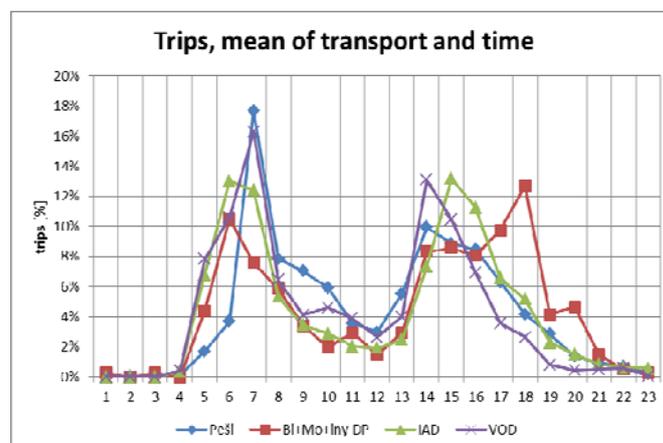


Figure 4. The comparison of trips, means of transportation and the daytime

That was just small example of data, which were gained from the household transportation survey.

3. The Applications of Survey

The data from the survey have been applied into Zilina Transport Model (ZTM) [4]. ZTM is an integrated multimodal model, which allows modelling traffic and urban environment, land-use and the interaction among them. The city in the model is divided into 120 zones and 378 subzones. The model allows also various level of modelling. The old data sets it is only possible compare in aggregate way, but current data sets is possible model with disaggregate approach. Most travel demand models account for mode and route shifts associated with induced travel, but many do not account for other induced travel effects such as changes in land use, number of trips, destination choice, and departure time choice. The representation of induced travel effects in travel demand modelling is critical to the accurate evaluation of road and public transport alternatives. For that reason ZTM allows the dynamic transport planning with gravity model. Dynamic gravity model, which already has proved its function [5] is suitable for modelling various socio-economic groups and various modes within time. The OD matrices of socio-groups are possible to assign on the network according the various transport mode.

The input data represents the statistical data in evidence of municipality, offices, transport companies and surveys. The model also works with survey data, which represent the intensity, direction, socio economical classes, etc. The problems with historical data sets consist in “level of detail” and therefore it is not possible to compare all parameters from the past to actual time. Especially, the method of daily travel diary and first travel pattern is suitable for aggregate transport model. It is clear that we cannot apply all data on the particular transport network assignment. The transport household survey just provided the useful data about the specific parameters, which are needed in order to calibrate and validate model. For example, the traffic volume in transport model is built on the data of traffic volume survey, which are realized by the university each year on the specific junctions and areas.

3.1 Land-use development and impact on the traffic

ZTM takes attention to analysing of zone, therefore each zone has been analysed with the respect to the land – use and compared to the historical data and especially for new complexes. That means that model evaluates the generation and attraction, type of land – use. At the current time the data for trip generation are divided according the land – use urban types: Home, School, Shopping, Relax, Cultural, Sport and Entertainment. Moreover the relationship between land-use factors has been evaluated and further analysed. For illustration, in last 20 years there are being presented or they are coming up early more than 50 big new sites that will have influence on trip generation and attraction. The comparison of old existing commercial areas (green) and new one (red) is showed on Figure 5. They will produce, respectively, attract around 10 thousand trips and moreover are focused on motorised transport. Two of them are under construction, but ZTM provided information about their future negative impact on the traffic quality in the city centre. The other part of problem is that these new complexes will not only attract the citizens from city of Zilina, but they will attract also citizens from surroundings and region. The seriousness of this problem is underlined by the fact that the city is missing a big number of parking places, and the current status is very critical.

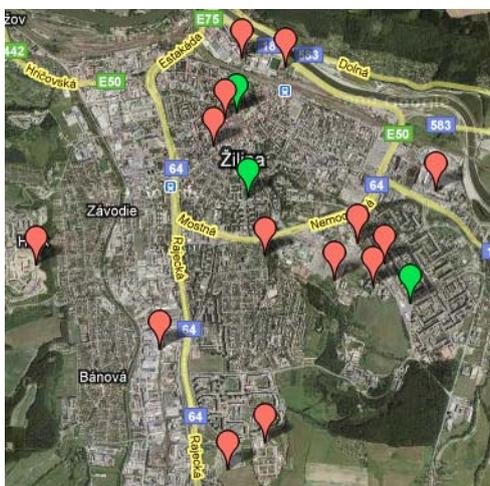


Figure 5. The comparison of development the commercial areas 1980 – 2009 (green –old, red –new)

The problem of development of new complexes and their relationship to the transport is that the development has been realized without an analysis how the traffic will change the situation in particular area. The ZTM pointed also on another problem of the new commercial centres situated into city centre which is related to its logistics. The commercial centres are big complexes, which require a lot of suppliers. These suppliers will represent the serious problems because in the city centre will be presented freight transport.

The transport infrastructure is not prepared on such kind of traffic volume. We have to take into account that it was built in the time with low car ownership rate. The current transport infrastructure is based on 3 city rings, which already have limited capacity. The problem of city centre causes a fact that it attracts the high volume of traffic. But this volume is possible explain with OD matrices and land-use with the following facts. The centre ring uses citizens to transit to the other parts of city but this is linked to the location of industrial zones, which are also situated between centre and city parts. The citizens mainly during morning and afternoon peak travel to centre but they travel via industry zones where business activity is present. The large areas of shopping centres are also situated between centre and housing sites. In afternoon peak it is significant that the people who are coming back to their home are facing to the people who are coming to these shopping areas. In these parts of infrastructure the roads have full capacity. The LOS on these roads is critical and reaches the level D, E, F. This problem doesn't cause only traffic but also environmental issues with increasing of emission. But this is not the only problem of traffic volume but also the problem of signal timing on junction, where is an absence of signal coordination.

Also the resident parking is very problematic issue. In the current time the city has a lack of 1000 parking places, which are extremely needed. For this reason the new resident parking policy will be introduced.

The city of Zilina has advantage and disadvantage that is situated on the very important transport junction. The main disadvantage from the transit point of view is that the highways ends in the western part of the city and then continues in the city transport network. The huge traffic flow from highway goes through the city ring to the east part of the city and there continues to eastern part of Slovakia, see Figure 6 – blue coloured. This status will be at least to 2019 when a plan of finishing highway should be realized.



Figure 6. The OD transit traffic volume (blue)

3.2 Changes in socio-economic groups

Together with development of economy and land-use, it is significant that in the city are presented the new socio-economical groups with new travel demand and manners. Each socio-economic group is characterized by the different travel habits and therefore is different also the means of transport. The ZTM divided the socio-economical groups into 2 basic classes. To the first class belong citizens whose travel habits are regular and therefore it is possible to forecast their behaviour and traffic impact. There belong employees, students, and pupils – groups, which behaviour is more or less standard. Then we have a new one the second group, which is represented mainly by businessmen who have irregular travel behaviour, because their activities are spread out within all areas and it is hard to model.

There are also different modal splits for socio-economical groups as employees, children, students, pensioners. In general, the households, which own the car and use it, will not change the means of

transport, especially when their members move from using of PT. For example, you can see the Figure 7, where is shown the comparison of modal split among the particular socio-economic groups. The negative trend shows that the number of children who travel with parents by car. Problem with children is that they don't use bicycles at all and potentially they are becoming dependent from cars. The PT is used mainly for travelling by students and pensioners.

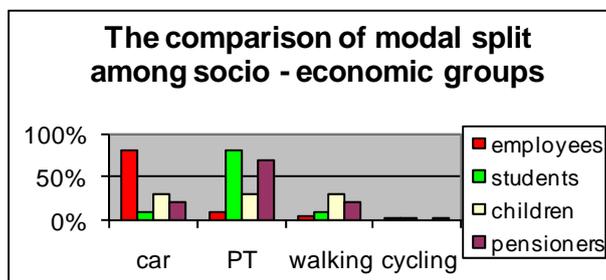


Figure 7. The comparison of modal split

Very important fact is that the inhabitants of new residential complexes are people with higher income and travelling mainly by car and the citizens with higher income produce also more trips with cars.

4. Proposal for Future Usage of Transport Survey Data

In order to ensure the systematic way of gaining and processing the data about land –use, transport and activities within the area, it is recommended to run the survey on the regular basis. For instance in Slovakia we run each 5 years the survey of road intensity. The last time it was in 2010, so in the 2015 it will be suitable to run also the household transport survey in order to have relevant data. Also the current status if information technology applications allow integrating the various sources in the process of transport planning and modelling in order to achieve very good basis for implementing the strategic actions within transport policy.

ZTM has pointed on the following problems and based on that some solutions have been proposed. First group of problems is related to the evaluation of urban and transport policy. The current traffic situation with relation to the land-use is only the result of bad urban policy from the past. Former policy-makers haven't respected the current urban master plan and allowed the development and building in the areas, which are not suitable for such kind of land use. These kinds of measures have caused and will cause the traffic changes because of problems with dimension of transport infrastructure and the current traffic intensity.

It is very important to take attention to the particular socio-economic groups that have significant impact on mobility within city and function of transport infrastructure [6-8]. The decision makers have to adopt regulation and measures in order to make the city transport system functional. Another problem is that in the city is an absence of good transport infrastructure for non-motorized transport as cycling, walking or handicapped.

The second group of problems is related to the organization of transport and technical issues. For improving the condition of traffic flow the signal optimisation in the junction has been proposed. Another problem is that the PT shares the same transport infrastructure with cars and the citizens don't see the advantage of its usage. The benefit for PT usage requires adopting the measures and policy, which will reduce the car usage in the city. Without changing the policy the PT will be not adequate alternative to the cars, but it remains as transport mode of second level. Because of the new shopping complexes, which are situated direct in the centre; the future organization of traffic will be necessary to change in order to avoid of city traffic collapse.

The recommendation for decision makers from ZTM is that it is time for accepting and developing a new urban and transport strategy implemented in urban master plan. The city of Zilina still doesn't have an updated urban master plan what can be considered as a mistake with negative consequences in the future.

One (Fig.8) is related to the status if the city transport and urban policy remains and decision makers will not adopt any particular restriction in organisation and managing of transport, the capacity of roads network will be extremely overloaded.

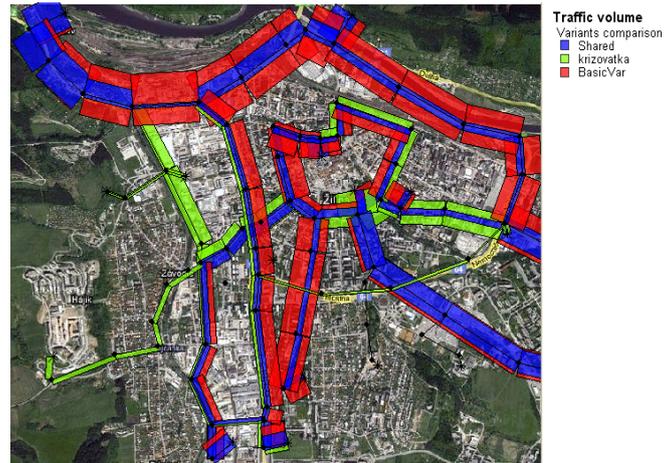


Figure 8. The traffic volume on main infrastructure in Žilina [6]

Moreover the various data can be combined with other traffic volume data or other data from traffic management, which can lead to the better transport model. For instance, it is possible to model at the level of micro-simulation the particular area, as it is shown on Figure 9.



Figure 9. The example of micro-simulation of commercial area in city of Žilina [9]

5. Conclusions

The issues of input data for transport planning process is very dependent on the data, which enter to the process of transport planning and modelling. This article has presented the approach that deals with the usage of transport survey and application in Žilina Transport Model. The possible obstacle in the way of efficient usage data are or can be caused by the reluctance of the public authorities to provide and gain data. This, of course, can lead to the inefficient spending of public finance and actions and measurements that will not lead to the sustainable transport and mobility within urban environment.

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