INFLUENCING TRAVEL DEMAND BY THE MEANS OF URBAN MOBILITY MANAGEMENT

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ABSTRACT

In this paper we evaluate the impacts which introduction of mobility management has on modal split and urban traffic system. Main objective of mobility management activities is to influence the travel demand in urban areas, thus the measureable impacts are changes in the modal distribution (modal shift) in favour of sustainable transport modes, reduction of the number of journeys and trips, increase of average vehicle occupancy, etc. The basic precondition for implementing the concept of mobility management is iterative model for trip assignment where user can choose and, more importantly, can adopt its choice of transport mode, time of travel, route and even destination. The concept of mobility management relies on the possibility to influence on these choices, especially in the cases when user doesn't pay the real costs for using specific transport mode. The methods of urban mobility management can be based on different pricing schemes (i.e. charging the use of transport infrastructure), special benefits for specific users (i.e. "carpool-only" parking spaces), providing the traffic information to the end users, etc.

KEYWORDS: mobility management, travel demand, modal split, evaluation

1 INTRODUCTION

In order to successfully solve the transport problems in urban areas, that is, to decrease various negative impacts like traffic congestion, air pollution, noise pollution and others, simple *build-only* concept cannot be applied. Numerous examples in different countries have shown that transport capacity expansion only leads into the greater problems when evaluating the long term impacts.

Meanwhile, different and innovative approaches have been developed in order to cope with constantly increasing transport problems. The objective of these new approaches and concepts isn't expanding the capacity of transport supply. The main objective is to use more efficiently

the capacity of available transport infrastructure by influencing on travel demand or, more specifically, by changing traffic behaviour of the citizens.

One of these new approaches is the urban mobility management, where the objective is to achieve a change in the modal split (modal shift) in the favour of more sustainable transport modes (public transport, cycling, walking). The concept of mobility management relies on the possibility to influence the travel demand, especially in the cases when user doesn't pay the real costs for using specific transport mode. Different authors ([4], [5]) did they researches on mobility management impacts on different scales (evaluating higher objectives or specific measure objectives), but the main changes can always be expected in the travel demand.

2 DEFINITION OF TRAVEL DEMAND

By the definitions provided in [2] and [3] travel demand can be expressed as the total number of requirements for the specific transport service, generated by users. Users can realize the service by the means of different transport modes and under the predefined conditions (price and quality). The realization of this service has an impact on traffic system, transport infrastructure and stakeholders involved in the process.

This means that generation of travel demand in certain area creates the transport problem in that area which can be solved by utilizing traffic entities (car, bus, bicycle, etc.) and using available network capacity. The transported entities (people or goods) have to be adopted according to the specific transport mode, network and traffic entities. Thus, in the process of transport planning and introducing different services, such as urban mobility management services, travel demand has to be quantified.

2.1 Travel demand quantification

One of the efficient and accurate methods for travel demand quantification is investigating citizens' traffic behaviour by conducting the modal split survey. Modal split represents the ratio of different transport modes in one journey from the origin (O) to the destination (D), [1]. In addition, the concept of multimodal journeys has to be acknowledged, because journey can be consisted out of different trips, due to the possibility of choosing several transport modes in that journey (Figure 1).

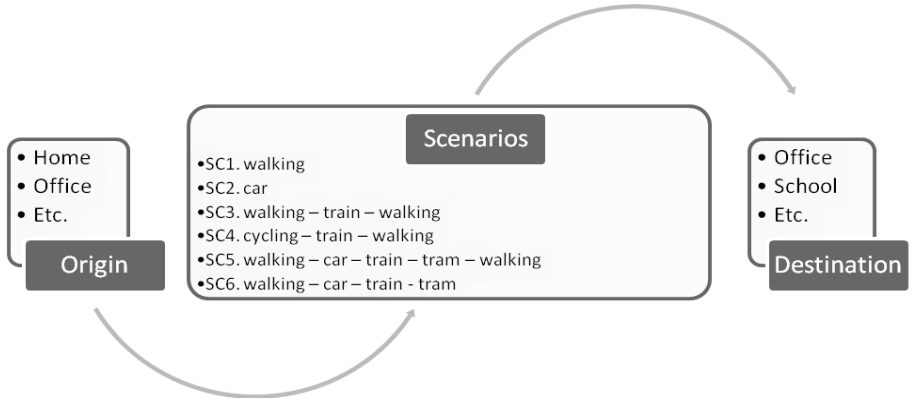

Figure 1: Example of different scenarios within one journey

With the modal split calculation the share of different transport modes in a single journey can be easily quantified. For the scenarios SC1 and SC5, depict in the Figure 1, results of modal split calculation are shown in the Table 1, as well as final modal spit for all scenarios.

Table 1: Modal split results based on scenarios shown in Picture 1

	SCENARIO 1		**SCENARIO 5**		**FINAL MS**	
MODES	One mode used from O-D		Five modes used from O-D		17 modes used in all journeys	
Walking	No. of trips 1	100%	No. of trips 2	40%	No. of trips 7	41%
Cycling	0	0	0	0	No. of trips 1	6%
Car	0	0	No. of trips 1	20%	No. of trips 3	18%
Train	0	0	No. of trips 1	20%	No. of trips 4	23%
Tram	0	0	No. of trips 1	20%	No. of trips 2	12%

Analysis of the modal split figures can help to detect the difference between travel demand and supply, especially in certain time periods or areas. In order to avoid a significant negative impact on travel times, traffic system performances and environment, demand/supply equilibrium has to be reached. In the cases when that cannot be achieved simply by expanding road capacity, a new services and regulations have to be introduced. Primary objective of these measures is to influence on travel demand, that is, trip assignment of individual users, by introducing new mobility solutions.

2.2 Trip assignment

Prior to the acceptance of the mobility management concept and its solutions, an iterative trip assignment concept has to be applied (Figure 2). This means that users have the ability to change or adopt their choice of travel according to the available services and information.

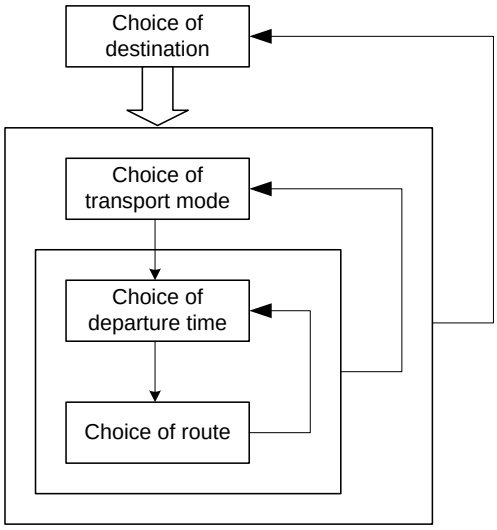

Figure 2: An iterative model of trip assignment

By implementing new urban mobility management services and regulations different choices which were made by each user individually can be affected. This can then lead towards efficient capacity usage due to the fact that travel demand can be allocated (redistributed) in space or time, or on another transport mode. An example of allocation of travel demand in time is shown in the Figure 3.

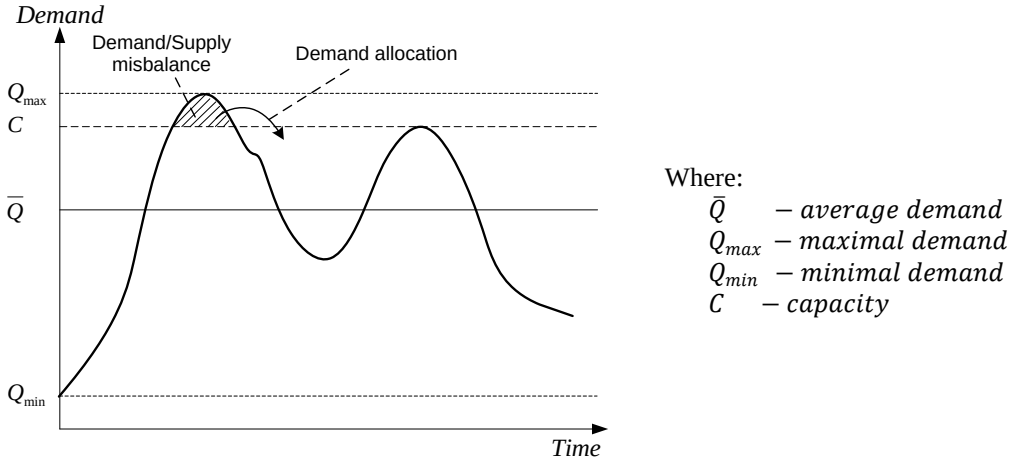

Figure 3: Example allocation of travel demand in time

One of the good examples of travel demand redistribution is the official appeal of Croatian Automotive Club during the summer tourist season. In the appeals, the Croats are instructed to delay their journeys for the workdays, because a large travel demand is expected from foreigner tourists during the weekends. In urban areas different measures can be applied in order to achieve the same effect. These measures can be grouped under one holistic concept – urban mobility management.

3 CONCEPT OF URBAN MOBILITY MANAGEMENT

According to [6] mobility management can be defined as a group of measures which have three basic objectives:

1. To influence on user need for transport
2. To influence on time or spatial transport distribution
3. To influence on user choice of transport mode.

Measures of urban mobility management are in fact a group of regulations, policies and services. They are the product of traffic strategic planning process in which the objectives are aimed at achieving sustainable urban development.

Most common regulation (measure) in the urban mobility management is introducing different types of charging schemes for the usage of transport infrastructure (i.e. congestion charging), [4]. In the Table 2 additional policies and services of urban mobility management are categorised.

Table 2: Different urban mobility management measures

CATEGORY	MEASURE (POLICY or SERVICE)
Charging the usage of transport infrastructure	• Parking ticketing • Congestion charging
Collective transport	• Carpool • Car share • Vanpool • Bus shuttle • Sharing a taxi

Individualized public transport services	• Transport on Demand • Demand Responsive Services • Transport of persons with special needs
Traffic and transport information distribution	• Real time traffic information (radio, TV, Internet, mobile phones, GPS devices, etc.) • Mobility Shop • Mobility Centre
Prioritizing specific users	• "Carpool only" parking spaces • HOV lanes (High Occupancy Vehicle)
Promoting cycling	• Public bicycles • Safe and secure parking spaces for bicycles
"Intelligent" working schedules	• Flexible working hours • Teleworking
Trip management within organizations	• Making the different transport plans for the employees • Deploying the collective transport services for the employees

Most of the abovementioned measures are often introduced together with other measures, especially when success of implementation depends on cooperation among different stakeholders or when specific measure requires specific knowledge and support.

4 IMPACTS ON MOBILITY

When analysing the impact of different urban mobility management measures on the travel demand it is evident that the modal split can only be changed in two ways as follows:

1. By achieving the modal shift
2. By reducing the number of journeys.

Different impacts of different measures can be evaluated on the higher, strategic level (this way the changes are expected in the air quality, noise reduction, decrease of congestion, etc.) or they can be evaluated on the much smaller scale, within a single organization for instance (here the possible impacts could be modal shift, less journeys, increased share of common trips within organization, etc.). Furthermore, when determining the possible impacts of urban mobility management measures different background impacts, like economic fluctuations or certain sociological trends, cannot be neglected. Background data can always be helpful when evaluating the impact of specific measures or a cluster of measures.

In the Table 3 impacts of different policies and services of urban mobility management are evaluated.

Table 3: Different impacts of different urban mobility management measures

	IMPACT ON:	
MEASURE	**MODAL SPLIT**	**TRAFFIC SYSTEM**
PARKING TICKETING	▪ Decrease of individual transport usage ▪ Increase of public transport usage	▪ Decrease of congestion in the zone ▪ Increase of number of available parking spaces

CONGESTION CHARGING	▪ Decrease of individual transport usage in the zone ▪ Increase of public transport usage	▪ Decrease of congestion in the zone ▪ Decrease of number of accidents due to the less vehicles
CARPOOL, VANPOOL	▪ Increase of average vehicle occupancy ▪ Increase of number of common journeys	▪ Decrease of number of vehicles on the road
SHARING A TAXI	▪ Increase of taxi usage ▪ Decrease of individual transport usage	▪ Decrease of number of vehicles on the road
TRANSPORT ON DEMAND	▪ Increase of public transport usage	▪ Decrease of number of vehicles on the road ▪ Increase of number of available parking spaces
TRANSPORT OF PERSONS WITH SPECIAL NEEDS	▪ Increase of number of journeys	▪ Increase of number of public transport vehicles
TRAFFIC INFORMATION DISTRIBUTION	▪ The impact highly depends on the information itself	▪ Shorter travel times ▪ Decrease of delays
“CARPOOL ONLY” PARKING SPACES	▪ Increase of average vehicle occupancy ▪ Increase of number of common journeys	▪ Decrease of number of vehicles on the road
HOV LANES	▪ Increase of average vehicle occupancy ▪ Increase of number of common journeys	▪ Decrease of number of vehicles on the road ▪ Degradation of transport performances for the low occupancy vehicles
PUBLIC BICYCLES	▪ Increase of bicycle usage in the short distance trips ▪ Increase of number of multimodal journeys	▪ Decrease of number of vehicles on the road ▪ Appropriate transport infrastructure is needed
FLEXIBLE WORKING HOURS	▪ Decrease of number of journeys during the peak periods	▪ Decrease of congestion during the peak periods ▪ Shorter travel times
TELEWORKING	▪ Decrease of number of journeys	▪ Decrease of number of vehicles on the road
TRANSPORT PLANS	▪ Increase the number of common journeys ▪ Increase of average vehicle occupancy	▪ Decrease of number of vehicles on the road

5 CONCLUSION

Nowadays transport system performances are very often under the influence of demand/supply misbalance. Because of this misbalance a numerous negative impacts can be easily identified and quantified. Furthermore, a simple capacity increase of transport supply cannot be considered as a long term solution to this problem. Instead, different and innovative approaches, like urban mobility management, have been developed in order to cope with constantly increasing transport problems. Main objectives of the urban mobility management measures is to influence on the traffic behaviour of the citizens, encouraging them to use more sustainable transport modes like public transport, cycling or walking. This means changing the travel demand.

When analysing the impact of different urban mobility management measures on the travel demand it is evident that the modal split can be changed in two ways:

1. By achieving the modal shift
2. By reducing the number of journeys.

In this paper several mobility management policies and services were categorised and their impact on modal split and traffic system was evaluated. If the implementation is successful, it is evident that almost all urban mobility measures have a positive impact on the modal split and on traffic system in general.

Different impacts of different measures can be evaluated on the higher, strategic level or they can be evaluated on the much smaller scale, within a single organization for instance. Furthermore, when determining the possible impacts of urban mobility management measures various background impacts (economic fluctuations or certain sociological trends, etc.), cannot be neglected.

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