

# Alternative transport systems in the function of micromobility

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**Abstract** – The paper will consider alternative transport systems as well as incentive measures to reduce the use of passenger cars in the visual distribution of travel, ie travel for business purposes, at the company level, as well as measures taken by companies to reduce passenger car travel.

**Keywords** – Mobility, Alternative Modes of Transport, Environmental Protection.

## I. INTRODUCTION

The increasingly rapid development of science and technology brings great changes in human life in terms of more efficient and effective mastery of space. Mastering space is a very important parameter in the daily life of people in cities, as well as the daily migration of residents living outside cities. When mastering the space of the inhabitants, a very important factor is the travel time.

In order to minimize this travel time, residents, when choosing means of travel, often choose a passenger car in relation to the situation, in order to satisfy their own living needs, and of course, the need to move. This choice of travel often comes down to the fact that in that passenger car, in addition to the driver, there are no passengers, but we have only one transported resident per passenger car [1].

The capacities of roads, as well as the intersections of roads, have certain values, so that each appearance of a passenger car on the mentioned roads and intersections prolongs the travel time compared to the mentioned capacities.

In addition, the constant trend of increasing passenger cars, causes traffic jams, increased noise levels, deteriorating air quality, deteriorating safety, quality of life, as well as various other problems characteristic of urban traffic [3]. Based

on this fact, it can be concluded that this trend of using a passenger car in the visual distribution of travel calls into question the "sustainability" of the transport system of any city.

The fact that huge financial resources must be allocated for the expansion of road capacities, brings a tendency to resort to alternative systems of transport of residents. In order to access these alternative systems of passenger transport, incentives are needed to influence the management of traffic demand, all at the expense of reducing the use of passenger cars in the visual distribution, and increasing the share of use by residents, public transport systems, promoting and increasing the participation of cyclists and pedestrians in traffic, as well as the integration of different modes of transport, as well as greater mobility of residents. The basic concept of these measures must be to raise awareness of environmental protection, in which users of passenger cars live.

Transport information and public campaigns can influence people's awareness, attitudes and behavior in such a way as to encourage the use of bicycles, walking and the use of public transport. Campaigns can be conducted to raise awareness of the general public, for target groups or as individualized campaigns [4].

One of the goals of mobility management is to find ways to meet the need to move through more efficient and integrated use of existing alternative modes of transport and infrastructure, as well as to improve cooperation between different modes of transport, facilitate interconnection and functioning of existing transport networks.

There are several ways to encourage passengers to switch from, for example, car to bicycle transport. Providing good access to cycling facilities can lead to an increase in the use of all forms of public transport as well as a reduction in the number of journeys made by passenger car.

Measures for the use of a private car are being taken in order to use it more efficiently. The measures are concentrated primarily on improving the traffic flow and increasing the utilization rate of the vehicle itself through the shared use of cars by several people. Actions aimed at helping drivers solve the problem of traffic congestion, aim to develop telematics technology within a broader integrated road network. Measures to increase car utilization rates include prioritization schemes for vehicles with three or more passengers.

The system integration of public passenger transport aims to concentrate all public modes of transport in a common operational environment. The three most important elements of

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the integrated system are coordinated timetables, the purchase of tickets valid for all journeys at the beginning of the journey and multimodal terminals, ie the physical, tariff and logical integration of the public transport system.

Globally, the challenge of climate change and its impact on the environment, health and the economy is strongly linked to transport and the behavior that accompanies unsustainable mobility [2].

The paper will consider alternative transportation systems, as well as incentive measures to reduce the use of passenger cars in the visual distribution of travel, ie travel for business purposes, at the company level, as well as measures taken by companies to reduce passenger car travel.

## II. ALTERNATIVE TRANSPORT SYSTEMS

In order to in a way reduce the number of trips made by passenger car, residents of any city must be offered an appropriate alternative of transportation that would have, if not approximately travel time, as well as travel time by passenger car, then certainly acceptable longer travel time for residents during the realization of their trip. Of course, the key factors when choosing an alternative to transportation, in addition to travel time, are the price of travel, as well as environmental protection, ie enabling a better and healthier life for residents in cities.

The main organizer of the city's transport system is the city itself. With its measures, as well as constant monitoring, research, and strategies, the city must define measures for coordinating the transport system, ie travel management. These measures should be primarily reflected in the price policy as well as price management, primarily the price of parking, and the price of transportation of public passenger transport systems [6]. The increase in the price of parking will certainly lead to the fact that the city has a larger number of trips realized by public mass transport systems, but this mass transport system must ensure the quality of transport service in terms of timetable accuracy, travel speed and travel comfort. These two concepts are very important for the choice of residents when deciding to make a trip, and giving a chance to alternative transportation systems.

In addition, the city must influence various measures, as well as subsidies to companies, which would reduce the passenger car travel of its employees.

In order for urban mobility to be sustainable, it is necessary, first of all, to develop models and guidelines for improving the conditions for the use of alternative modes of transport, in the field of [6]:

- taxi service,
- bicycle traffic,
- pedestrian traffic,
- inland water transport,

- other alternative systems that have potential.

## III. MEASURES TO ENCOURAGE GREATER USE OF ALTERNATIVE TYPES OF TRANSPORT

Managing the demand for travel by applying land use policy instruments implies the creation of various forms of urban form that encourage greater use of environmentally friendly modes of transport. Increasing the intensity of land use and combining different types of activities at the same location results in acceptable walking distances at which to travel. At the same time, preconditions are being created for quality servicing of city by the public transport system.

With the appropriate land use policy, the number of passenger car trips can be reduced by 10-30% [4]. Research on trends in the relationship between the distance traveled and the choice of mode of transport in German cities over the past thirty years has shown that the impact of built space has a strong impact on two elements of traffic demand: distance traveled and choice of mode [5]. According to the same author, the influence on the choice of mode of transport can be divided into direct and indirect.

1. *Indirect impact.* Increasing the density of content with the necessary combination of a number of different activities (mixed use) reduces the distance over which the trip is performed. Reducing the distance increases the possibility of traveling on foot or by bicycle.
2. *Direct impact.* Densely populated areas usually have a more developed public transport network, which with a limited number of parking spaces and large traffic jams results in a comparative advantage of public transport and its greater use compared to the car.

In addition to the positive effects of land use management, which are reflected in the reduction of dependence on car use, it is important to emphasize the reciprocal impact that the promotion of alternative modes of transport has on land use. The positive effects are reflected in the increase of accessibility to urban sub-units and as a consequence of accessibility, the increase in the attractiveness of various commercial and entertainment contents. Thus, for example, the relationship between retail trade turnover and pedestrian traffic intensity has been established, and even in some cases it has been proven that the value of land in the central business area is directly related to pedestrian traffic intensity [4].

The changes in travel that result from surface management strategies can help solve various traffic problems and achieve the goals of sustainable urban planning.

In addition, what needs to be emphasized is the elaboration of campaigns and strategies that influence the change of behavior of transport system users, ie passenger car

users, in the context of promoting greater use of alternative modes of transport at the expense of reducing passenger car use.

Based on world experience, measures to promote greater use of alternative modes of transport in cities, which have been implemented, show that the best results have been achieved by applying:

1. Campaigns and promotional measures for pedestrian and bicycle traffic and public transport, which resulted in a reduction in the participation of cars in the visual distribution of travel;
2. Individual travel counseling to help reduce car use;
3. Compensation for employees who use public transport instead of a passenger car;
4. School mobility plans that enable children to walk safely to school;
5. Measures of car sharing (joint driving) and carpooling (joint car rental).

#### IV. LIVEMOBILITY

When it came to travel management measures, travel management at the company level was mentioned. Every company is responsible for providing its employees with a comfortable and safe trip with the purpose of work, which is financially regulated. The social responsibility of companies, in addition to the compensation they give to their employees in order to regulate travel to and from work, is also reflected in the impact on the environment. That is why an increasing number of companies want to manage to travels of their employees [7]. This can be achieved by using modern information technologies that track, store travel data, provide real-time information about the mentioned trips, based on which a travel management algorithm can be created, and easily measure travel savings or costs, as well as the impact to the environment.



Fig. 1. Livemobility

Livemobility is an application that deals with tracking, storage and thus the management of travel data at the company level. Based on the company's research, when creating an algorithm for this application, it was found that about 20% of global warming comes from population mobility, and that 20% of CO2 emissions can be reduced by using this software [5].

#### 4.1. Livemobility Structure

The structure of Livemobility is reflected in three entities that are of significant influence if the application is observed at the level of a certain company. The three entities are:

1. Users, ie employees;
2. Dispatch Center, which with the help of the mentioned application collects, stores and processes data on trips of users, ie employees. Also, in addition to this, they deal with monitoring the work of the application, as well as eliminating existing problems in the work of the application.
3. The Main Control Center, which on the basis of data obtained from the Dispatch Center, implements strategies, manages trips through subsidizing points to users and performs travel analysis.

It is very important to mention the coordination between these three entities, which must be at an enviable level, in order to benefit from the use of platform.

#### 4.2. Phases of Impelmentation Livemobility

In order to implement the mentioned application, it is necessary to consider it in phases. This phased or phased review of the implementation can be done as follows:

**PHASE 1** This phase is reflected in the research of the current situation at the company level and includes:

1. Internal call to its employees by the company and introduction to the benefits of the mentioned application.
2. Filling out an online survey of employees, where the most important question is the length of the trip. The mentioned application was implemented in a hospital in the Netherlands, where it was determined that the average length of employees in that hospital is 7.5 km.
3. Registration of employees in the application, as well as training for the use of the mentioned application.

**PHASE 2** This phase is reflected in motivating employees to switch from a passenger car to alternative modes of transport. Employee motivation is implemented through two levels:

1. Internal motivation of employees, where the employee sets goals for how to travel to and from work, where he will get the least points if he travels, or will not be scored if he comes by car, and the most points if he travels on foot, or by bicycle to work and from work. This motivation of employees can be realized at the level of the work unit in the company, where team spirit is enhanced.
2. External motivation of employees, which is reflected in the awareness of reducing travel costs, and reducing the negative impact on the environment.

**PHASE 3** This phase is reflected in a concrete change in the behavior of employees in terms of the implementation of the said application, and the transition from a passenger car to alternative modes of transport. Of course, phase 3 is primarily reflected in the gamification of employees, where there can be competition and collection of points that can be used during various purchases and obtaining various subsidies and compensations for similar points. Of course, the employee can control panel on any account, on his smartphone or desktop computer.

## V. CONCLUSION

Alternative transport systems have a major impact on the sustainability of cities, as well as on population mobility. All developed cities have agendas or strategies for developing alternative transportation systems. What is significant is that these strategies cannot just be rewritten as a model for our cities. It is necessary to first perform an analysis of the current situation, and only on that basis, as well as on the basis of knowledge of strategies for the development of alternative transport systems, to develop and design a strategy for the development of alternative modes of transport.

The plain terrain, especially in Vojvodina, is conducive to the use of bicycles as an alternative means of transportation. However, in addition to the appropriate infrastructure, integration with public mass transport, safer parking lots, larger investments, as well as bicycle rental campaigns, etc are needed.

Unconventional systems such as funiculars or cable cars can also be used as alternative transport systems, especially in cities that have a historically important facility such as a fortress. This would significantly improve the tourist offer, and thus the tourist attractiveness.

The basic concept of the development of mobile and sustainable cities is to give priority to walking, cycling, as well as public transport systems. Travels realized by a passenger car leave as much space as is left.

What is important to note is that the already mentioned strategy of transport system development should be harmonized with this concept. The reason for these measures and the adoption of a strategy for the development of transport with the participation of alternative transport systems is that the road infrastructure has already been set, ie cities with their content and road capacities have already been built, their expansion is very expensive and these measures would apply to some so-called "hard" measures.

In our conditions, it is more tangible to apply some "soft" measures, ie lighter measures, where through campaigns, strategy adoption, with the existing infrastructure, changes in the visual distribution of travel would be influenced.

By introducing knowledge through education, both about health and mobility, and raising awareness of the environment in which we live, we should strive for species distribution with the use of alternative modes of transport in as large a percentage as possible.

What is interesting is that in some countries, exercises can be organized that can be done while waiting for the funds of the public mass system at the standpoint. In order to affect the health of the population and to reduce the waiting time experienced by service users.

In addition to all of the above, the involvement of companies in the travel management of their employees and their subsidization by the city is crucial for reducing travel costs and reducing the negative impact on the environment. By using the Livemobility platform, the hospital in the Netherlands has reduced the total travel costs of its employees by 30% and 75% less CO<sub>2</sub>, without this being reflected in various employee delays, as well as any reduction in employee mobility.

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