

# CARPOOLING AS A MEASURE FOR ACHIEVING SUSTAINABLE URBAN MOBILITY: EUROPEAN GOOD PRACTICE EXAMPLES

MSc.Eng. Parezanović T.<sup>1</sup>, Petrović M. PhD.<sup>1</sup>, Bojković N. PhD.<sup>1</sup>, Prof. Pejčić Tarle S. PhD.<sup>1</sup>  
Faculty of Transport and Traffic Engineering – University of Belgrade<sup>1</sup>, Belgrade Serbia

t.parezanovic@sf.bg.ac.rs, m.petrovic@sf.bg.ac.rs, n.bojkovic@sf.bg.ac.rs, s.tarle@sf.bg.ac.rs

**Abstract:** Growing problems of transportation in urban areas in terms of congestion, air pollution, reduced safety and comfort, occupation of the space, are creating the need for innovative mobility strategies and exchanging good practices. One of the measures that can help resolving these issues is urban carpooling that decreases the number of private cars traveling to/from a desired destination site. This paper focuses on good practice examples of carpooling in Europe and potentials for transferring knowledge and experience. Several implemented concepts of carpooling are discussed in terms of resources and implementation effects. The paper concludes with recommendations for stepwise implementation of carpooling concept.

**Keywords:** CARPOOLING, SUSTAINABILITY, URBAN MOBILITY, GOOD PRACTICE, IMPLEMENTATION

## 1. Introduction

Urbanization and rapid expansion of the cities produce pressures on urban transport systems that tend to affect the quality of life of urban population more than ever. Reduced mobility options and inadequate transport infrastructure, increasing congestion, pollution and traffic safety problems are some of the major problems that require a systematic approach to be resolved. An increasing number of European cities are faced with the problem of growing transport demand and insufficient capacity of the transport network to support them. This is particularly evident in cities that were not sufficiently committed to strategic plan for sustainable mobility. In the last decades these cities were faced with high motorization rate and modal shift in favor of passenger cars.

To achieve effective functioning of urban transport system, it is very important to provide different modes of travel, which would have a positive impact on the mobility of citizens. Accordingly, sustainable urban mobility in cities is a major challenge and complex task for traffic engineers, urban planners and other professionals, as well as to the population that need to acquire new behavior and travel patterns. Mobility management or transport demand management includes measures of various types and nature whereby they have a common aim to reduce the use of passenger cars. One of these measures is carpooling – the concept that does not preclude the use of passenger cars but makes its use more efficient. In that sense it can be regarded as equally attractive to transport policy makers and users/citizens themselves.

The subject and the aim of this paper is to indicate the potential and contribution of carpooling in pursuit sustainable mobility based on the experience of application within the CIVITAS (City-Vitality-Sustainability) Initiative. The paper deals with the opportunities to spread carpooling based on lessons learned and experiences of previous applications as well as CIVITAS guidelines.

The paper is organized in the following way: in the next section the explanation and types of carpooling are given. Section 3 presents evidence of performance. Thereafter, section 4 highlights the potentials of implementing carpooling in the city of Belgrade as well as some obstacles. Section 5 concludes the paper.

## 2. Carpooling concept

Carpooling is the transport concept/measure based on a shared use of private cars in order to reduce the number of single occupant vehicle users. The idea of carpooling was born in the 1970s in the USA, when shortage of oil and rise of fuel costs motivated people to share their rides with neighbours or colleagues. So far, there is no single definition of carpooling. According to the most commonly adopted definition carpooling is “the agreement of joining the use of a private car by several individuals frequently commuting along

the same journey at jointly compatible times” [1]. Hence, carpooling is usually associated with very simple idea: two or more persons sharing a whole trip, or a part of it, with the passengers contributing to the driver’s expenses. Based on this, it can highlight two main characteristics of carpooling. First, a group of people voluntarily joins together for sharing the costs of some particular journey. Second, one person from the car decides to offer his own vehicle to be driven to the common journey.

The term carpooling is sometimes referred as ride-sharing. However, ridesharing is a broader concept because it includes not only carpooling system, but also other sharing systems like taxi or bike trip. Besides, carpooling rather refers to commuters and regular rides, while ridesharing is commonly used for single ride on long distances.

The advantages of carpooling are discussed in many studies. Besides positive effects that arise from reduced car travel, like decreasing pollution, traffic congestion and the need for parking space, an important advantage of carpooling is the reducing of individual travel costs [1],[2],[3]. According to evidence from practice, the uptake of carpooling can induce significant mode shift. It can even replace the use of public transport for commuting [1]. However, this is not consistent with mobility management principles. Namely, although carpooling can be considered as a more preferable than solo-driving, it is still less desirable and efficient than non-motorized or collective, public transport. Therefore, it is recommended to avoid the competition between public transport and carpooling. It is even necessary to be cautious in granting subsidies to carpooling because its excessive favouring can outperform more sustainable urban transport modes [2].

There are several forms of carpooling, mainly differing according to their formal character and the way of matching [4]:

- Informal carpooling (slugging, casual carpooling): practiced in areas that have HOV (high occupancy vehicle) lanes<sup>1</sup>. Drivers pick up commuters near a HOV lane, at a bus stop or a parking lot and take them to central area. Passengers typically do not share costs with drivers, whose main advantage of carpooling is a shorter travel time by using a HOV lane.
- Pre-arranged carpooling: most common form of carpooling. Systems and services offering this form of carpooling rely on internet based databases that match drivers and passengers and arrange a meeting point in advance. Passengers usually share costs with the driver or they pay the carpooling service some fee for membership or for successful matching.

<sup>1</sup> High Occupancy Vehicle lanes – reserved for vehicles with a driver and one or more passengers

- Real time carpooling (instant, *ad-hoc* or dynamic carpooling): emerged from the flexibilisation of working times. Service providers offer real-time matching: commuter's demand is instantly matched with a compatible offer in order to keep waiting times as short as possible.

Generally, carpooling can happen in a spontaneous way, as is the case with common household members trips or friends and colleagues travelling together. Accordingly, carpooling can be differentiate as internal or external [2], whereby the internal one appears in the above described situations. It is characterized by a high degree of confidence between carpoolers. On the other hand, the external carpooling happens when there are no specific relation or previous communication between carpooling members. This kind of carpooling is therefore more demanding in terms of organization. This is not only because of possible resistance and mistrust, but also because of the need to determine the location of the carpooling checkpoints. Additionally, the origins and destinations of driver and carpoolers or carpoolers themselves may be different, which implies the need for complex organization from external sources.

Table 1 summarizes some forms of travel arrangements within a carpooling concept.

**Table 1:** Some characteristics of carpooling

Degree of connection	High	household memebres
	Medium	friends, colleagues, neighbours, etc.
	Low	unrelated people
Origin/destination (O/D)	O	matching
		non-matching
	D	matching
		non-matching
Travel organising	spontaneous	
	pre-arranged	
	dynamic	
Financial aspects	household budget savings	
	individual travel costs savings	

### 3. Carpooling in Europe – good practice examples

A number of studies and initiatives promote the concept of sustainable mobility. One of them is the CIVITAS initiative whose aim is to support financing sustainable mobility projects and provide the platform for knowledge exchange. The CIVITAS initiative put emphasize on measures that favour efficient and environmentally less harmful transport.

Together with other initiatives that promote sustainable mobility like EPOMM<sup>2</sup> (European Platform on Mobility Management) or KonSult<sup>3</sup> (Knowledgebase on Sustainable Urban Land use and Transport), CIVITAS project eventually became important knowledge database in this area. Based on practical application, the policy makers have gained valuable insight and evidence on performance for many soft policy measures whose potentials are often questionable. By now, more than 200 cities across Europe joined CIVITAS. They are committed to test innovative urban mobility measures and exchange good practice. Since 2002, CIVITAS initiative has realized a number of carpooling measures in many different cities. A brief overview of some of them is presented below [5].

In Debrecen (Hungary), one of the largest university towns in Hungary, carpooling was an innovative solution. With the participation of university student organizations and the use of their intranet, a service for pairing driving was created. The service was promoted by local television and radio stations, leaflets and the university intranet. After completion of the implementation of this system in 2008, there were 100 registered users and 204 ads placed - information about sharing rides. Given that it was a completely new project, the efficacy is obvious.

As well as in Debrecen, the city of Krakow in Poland, began with the implementation of this system primarily for the needs of universities and students, but the ultimate goal was the inclusion of all residents of Krakow. During the first year of implementation, the project under the name *Let's ride together* attracted 700 users, while the number of registered monthly trip varied from 30 to 50. However, two key barriers in the application of carpooling were detected - the fear for personal safety and the unwillingness of sharing rides with strangers.

In the city of Rome, the primary objective of carpooling system was reducing congestion in the central city area, as well as promoting more efficient ways of using the car. In order to determine the characteristics of travel in the project area, the extensive research with about 100 000 questionnaires was conducted. A simulation model designed to manage carpooling services was developed and installed. The results of the application of these measures were encouraging: a total of 1 180 carpooling users were registered, while the occupancy vehicles raised to 75%.

The concept of carpooling in Perugia (Italy), was primarily intended for students and staff at the University of Perugia. During the implementation the specific prototype-gate was developed. It was able to verify the number of people in the vehicle before entering the parking space designed for carpoolers, by reading occupant's smart cards (prepaid cards for carpooling). Vehicles with three or more passengers were allowed to access the parking lot. Thus, car owners were enforced to increase the occupancy of their vehicles.

In Toulouse (France) carpooling Association Covoitural operated within the existing mobility center established by the operators of public transport Tisséo who granted it official status. Within two years (2005-2007), the number of registered users increased from 194 to 1 866, where as many as 17% of users shared drive on a daily basis. For this period, about 1 600 000 kilometers were avoided, with a saving of 340 000 kg of carbon dioxide equivalents.

Within CIVITAS II project in the German city of Stuttgart, carpooling application is tested for the purpose of major sporting and other events in the city, or in cases where there is a high demand for transport to the same place at the same time. Existing system-portal for registration and booking driving Pendlernetz Stuttgart was adapted to travel for the purpose of attending sport events, concert, etc. The promotion of this system in particular has contributed to the football club Stuttgart and VfB Stuttgart, for example through the club newsletter and stadium display screens. Also, more than 45 major companies in Stuttgart participated in the organization of promotional campaigns, creating presentations, posters and flyers to their employees presented this new system. As a result of the measure, the demand for carpooling system increased: the number of hits rides on the carpooling portal increased from around 200 000 in 2005 to more than 800 000 in 2008. The fact that more than 120 companies and about 40 municipalities in the region promote the link Stuttgart Pendlernetz Portal confirms the growth of public awareness.

In many other cities across Europe the idea of avoiding solo driving is appearing. For example, the carpooling system in Belgrade still does not exists in the way it is intended to be - for commuters and regular daily rides. Instead, there are recently introduced systems of sharing rides mainly across country and for one-time purpose, which can accordingly be rather considered as

<sup>2</sup> [www.epomm.eu](http://www.epomm.eu)

<sup>3</sup> <http://www.konsult.leeds.ac.uk/>

ridesharing concept. The information about them is available on the web platforms, [www.blablacar.rs](http://www.blablacar.rs) and [srbija.timskavoznja.com](http://srbija.timskavoznja.com).

However, there is no evidence about the share of carpooling traveling within the city of Belgrade. Anyhow, the carpooling concept still has no media attention and the citizens are generally poorly informed about it.

#### 4. Obstacles and potentials for implementation of carpooling

An efficient use of carpooling system requires the involvement of all stakeholders: government, the ministries, local authorities, state institutions, big and small-size companies, employers, all citizens. For the introduction of carpooling, it is necessary to define the basic parameters affecting the proposed system. The starting point for the application of this concept would be the research about the attitudes and knowledge of the carpooling benefits, thereafter the survey on willingness to accept it.

At the same time, it is necessary to collect traffic data before and after the application of carpooling. These include the average number of daily motorized travel, the motorization rate, modal split, travel distribution by purpose, total volume of traffic during the day, desire lines, etc. In this way the efficiency and effectiveness can be monitored and perceived. Larger companies would be expected to be main holders of the application by encouraging employees who enforce carpooling in different ways - through awards, days off, secured parking spaces, etc.

It is also necessary to design a unique mode of travel pairing and reservations aimed at automating these processes in real time or booking in advance through modern information and communication technologies (creation of forums, web sites, portals, and mobile applications for on-line booking rides). In this regard, it is necessary to define the location of terminals according to the requirements of potential users (commuting).

Knowing that the application of carpooling affects the reduction of passenger cars usage and thus improves sustainable mobility, the city authorities should provide additional requirements for the use of carpooling on the existing transport infrastructure. It may include giving priority to vehicles with a large number of passengers, marking lanes for vehicles with high occupancy lanes (so called.HOV lanes), integration of carpoolers with public transport, as well as policy instruments for stimulation of carpooling in the transport market.

Given that carpooling is a measure that affects the independence and convenience of travel, it is very important to provide as strategic plan for the additional user's motivation. For this purpose it is necessary to organize campaigns, education and promotion of sustainable modes of transport for all stakeholders. It is also necessary to raise awareness of the general public about the importance and possible contribution of carpooling aiming to enhance public acceptability of this and similar measures.

For a comprehensive understanding and differentiation of barriers a research conducted for the city of Zagreb can be useful. They distinguished four types of barriers – technical, organizational, financial and political [6]. Some of the listed barriers are universal by nature and should be considered elsewhere. The major challenges are infrastructure problems, organization of communication among users, building adequate information systems and dispatcher activities. The lack of clear concept of financial and/or other stimulations for drivers and costs compensation for cars has a negative impact on motivation for becoming drivers in the carpooling system.

It seems that one of the key preconditions in the successful implementation of carpooling is to draw up ride-matching schemes. This implies availability of service at a time when users need it. For that purpose, harmonized work schedules are required, which is not

always easy to achieve, and which is also the subject of change. That is why large companies should be active participants in the implementation of the concept. In order to encourage companies and enhance their interest to act proactively carpooling should be considered as a part of their overall environmental performance. If the environmental benefits are attributed to the company that has introduced carpooling, it will be one way to enhance their motivation.

Based on these observations and evidence from practice, the SWOT analysis (Figure 1) of carpooling can be a useful tool for policy makers and other stakeholders.

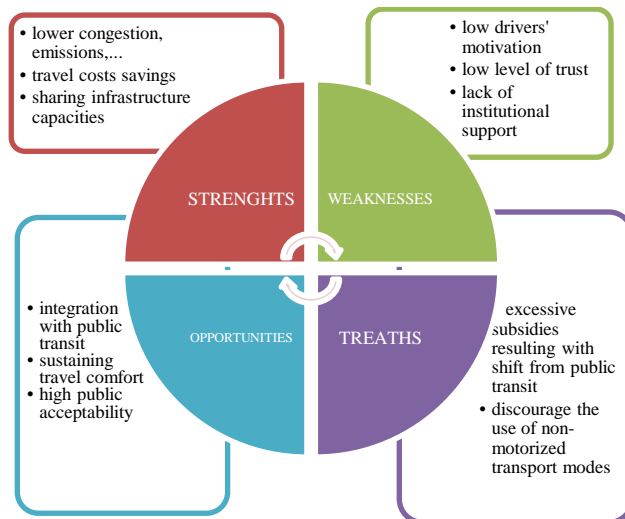


Fig. 1. SWOT analysis of carpooling concept

This kind of analysis provide the answers on the advantages of the concept, its potential for improvement, opportunities to disseminate and obstacles for implementation.

#### 5. Concluding remarks

Carpooling is gaining importance as a mean to expand travel options. However, as summarized in the paper there are many challenges ahead. Existing practice examples show that there are various levels of implementation:

- Cities with significant number of carpoolers among whole citizens and with existing intuitional support for this concept;
- Cities implementing pilot-projects for a limited period and for particular user- group;
- Cities where carpooling is not organized in original form but as ride-sharing scheme at the regional level;
- Cities without any form of carpooling.

Moving towards carpooling implementation implies several key issues to be considered by policy makers. These include:

- Learning from good practice examples/sharing knowledge and experiences from cities that successfully implemented carpooling;
- Providing detailed travel plans that cover the highest possible percentage of population;
- Finding suitable pick-up points for carpoolers;
- Marketing activities to encourage citizens to accept carpooling;
- Encouraging big companies to be main holders of the implementation by including carpooling scheme in their overall environmental performance.

In addition, although more preferable than solo-driving, carpooling should not be designed as competitor to more efficient urban transport modes (public transit, non-motorized modes) but

rather to be planned as a part of joint effort to achieve sustainable urban mobility.

## 6. References

- [1] Galizzi, M., 2004. *The economics of carpooling: a survey for Europe*. Workshop, University of Bergamo, Italy.
- [2] Vanoutrive, T., Vijver, E.V.D., Malderen, L.V., Jourquin, B., Thomas, I., Verhetsel, A., Witlox, F., *What determines carpooling to workplaces in Belgium: location, organisation or promotion?*. *Journal of Transport Geography* 22, 2012, 77-86.
- [3] Abrahamse, W., Keall, M., *Effectiveness of a web-based intervention to encourage carpooling to work: A case study of Wellington, New Zealand*. *Transport Policy* 21, 2012, 45-51.
- [4] Handke, V., Jonuschat, H., *Flexible ridesharing - new opportunities and service concepts for sustainable mobility*. Springer, Berlin, 2013.
- [5] Civitas Initiative – Clean and Better Transport in Cities, *Sustainable mobility highlights 2002-2012*, Available from: [http://www.civitas.eu/sites/default/files/documents/file/2013\\_car-independent\\_car-pooling.pdf](http://www.civitas.eu/sites/default/files/documents/file/2013_car-independent_car-pooling.pdf)
- [6] Slavulj, M., Grgurević, I., Golubić, J., *Analysis of possible risk in introducing congestion charging and carpooling measures in Zagreb*. In: Longhurts, J.W.S., Brebbia, C.A., editors. *Urban Transport XVIII: Urban transport and the environment in the 21<sup>st</sup> century*, WIT Press, 2012, 433-445.

## Acknowledgements

This paper is a part of the project “Critical infrastructure management for sustainable development in postal, communication and railway sector of Republic of Serbia”, funded by the Ministry of Education and Science of the Republic of Serbia, Project number: TR36022.